Rethinking deindustrialization and health across time and space

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Abstract

The transition towards a service-based society, defined as deindustrialization, has led to an extensive body of research exploring the socio-economic and health impacts of industrial decline. The literature has been mainly confined to the regional effects of unemployment and inactivity. However, considering the morbidity and mortality outcomes of this event, most studies have focused on single cases such as regions and specific industrial occupational groups. Within this context, this thesis aims to assess the health-related implications of deindustrialization by considering the elements of contrast, magnitude and time. Those elements capture the dynamic nature and uneven pace of industrial decline across different levels, aggregated and individual.

This thesis measures and compares the severity of industrial decline across Europe and seeks to identify whether deindustrialization is associated with mortality variations. By including fixed effects modeling it distinguishes between the long and short-term relationship of industrial decline and mortality. Furthermore, this thesis adopts a longitudinal perspective and aims to explore the long-term self-assessed morbidity of various occupational groups by following their transition towards unemployment, inactivity and re-employment. The analysis follows a logistic regression approach based on the evaluation of self-assessed morbidity.

It concludes that deindustrialization is a transitional event that progresses unevenly and disproportionately affects health at national, regional and individual levels. At a population level, industrial decline appears to be beneficial for health as countries have progressed towards the creation of safer contemporary working environments. At an individual level, the transitional effects of occupational mobility do not uniformly influence the morbidity of individuals.

The extent of the susceptibility of certain countries, regions and population groups towards this event is a result of various internal and external socio-economic factors, health-related and political decisions. Subsequently, this thesis introduces the necessity of rethinking the health consequences of deindustrialization, whereas future research should consider the changing nature of employment within the industrial and service sectors.

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Chapter 1

Introduction

1.1 Background

The transition from an industrial to a service-based economy, commonly described as deindustrialization, constitutes an uneven socio-economic transformation. The magnitude of this event has led to an extensive literature concentrated on the economic origins and implications across countries and regions. However, regarding the health implications of industrial decline, research has demonstrated mixed results. Most studies have explored the association between industrial decline and health by utilizing either ecological (such as spatial, survey-based, aggregated) or qualitative information but not individual level data. Furthermore, most studies, with few exceptions (Walsh et al., 2010b; Holland et al., 2011; Taulbut et al., 2013), are mainly case studies such as countries, industries or specific population groups. Therefore, the main constraints are concentrated on the type of data used and the limited number of comparative studies.

At an aggregated and regional level, industrial contraction has been accompanied with a rapid increase of unemployment and inactivity levels across regions. Those old industrial regions are characterized by concentrated deprivation and ill-health (Danson, 2005; Mitchell et al., 2000). Behind the intensification of hidden unemployment, inactivity mainly disguises those former industrial employees who are unwilling to adjust to the new economic circumstances or unable to seek employment in non-manual occupations, characterized as *"discouraged workers"* (Fieldhouse and Hollywood, 1999; Murray et al., 2005; Nixon, 2006).

Contrary to the negative consequences of industrial decline, through the route of unemployment and inactivity, several studies have identified positive health outcomes. Those mainly qualitative studies have emphasized male employees dismissed from the industrial sector and explored their likelihood of re-employment in other sectors. It is well established that some industrial working environments are responsible for unfavourable health outcomes, such as lung cancer, cardiovascular disease and fatal injuries (Hein et al., 2007; Kivimäki et al., 2002). As expected, a reduction in accidents, fatal injuries and related diseases of the digestive system has been observed for individuals who left industrial employment (Bartley and Fagin, 1990; Richardson and Loomis, 1997). Additionally, re-employment in non-industrial jobs has contributed to the decline of emotional distress and improvement of overall health (Ostry et al., 2002).

While deindustrialized areas are likely to demonstrate elevated morbidity, since they suffer from high levels of deprivation, inactivity and unemployment, nevertheless the population in those regions is not homogeneous. Beyond these area effects, the socio-economic and demographic characteristics of individuals, who are out of employment, might influence the formation of subsequent morbidity and mortality outcomes. On the other hand, the nature of employment, for example being currently or previously engaged in different industries or other sectors of the economy, might be associated with various health differentials (Riva et al., 2011b).

In order to identify in more detail those health outcomes, various scholars have addressed the issue of a necessary contrast between industrial employees who survived the downsizing of industries compared to employees who faced unemployment (Ostry et al., 2000). Therefore, there is a need for considering additional information on the socio-economic attributes of individuals. These elements could assist in explaining variations in morbidity among employees within similar or diverse industries. In addition, the identification and exploration of more vulnerable occupational groups affected by industrial contraction together with a long-term follow-up of occupational transitions of those groups might overcome some of the limitations of the current literature.

Deindustrialization has been an economic transition shared by numerous countries across the globe. However, its progression has varied in pace and timing. Furthermore, international comparative studies assessing those elements, within the context of industrial decline, are limited (Walsh et al., 2010a; Taulbut et al., 2013). In a

broader perspective, comparative research has extensively explored the relationship between economy and mortality. Taking into consideration other economic events, such as recessionary periods and rises in unemployment, those studies have already revealed the amplification of certain causes of death and the reduction of others. For instance, economic expansions are associated with an increase in cardiovascular and respiratory diseases as well as traffic accidents. In contrast, economic contractions have been related to accelerations of suicides and homicides (Ruhm, 2000; Neumayer, 2004; Gerdtham and Johannesson, 2005).

Even though the termination of industries has affected numerous regions, areas and communities, nevertheless its magnitude is influenced by the progression of the economy as a whole. For example, a study conducted by Robinson and Shor (1989) has revealed that cyclical downturns of the whole economy influence the decline of injuries in the manufacturing industries. The reduction of employment in industries has been more constant compared to business cycles. Since deindustrialization expresses a transition from industries to services, it has progressed for a longer time period starting from the 1970s in most countries. On the contrary, business cycles fluctuate for shorter time periods, are usually influenced by global economic variations and expressed as business contractions (recessions) and upturns. However, it is reasonable to hypothesize that during economic downturns the reduction of employment in the industrial sector could be further accelerated compared to periods of economic expansion. This could possibly result in the intensification of certain causes of deaths such as suicides.

In the same context several scholars have addressed the issue of considering additional dimensions in determining the health impacts of industrial decline such as cyclical unemployment and undesirable physical and psychosocial work conditions (Ostry et al., 2001). Furthermore, Morris and Cook (1991) have recognized that most studies looking at factory closures are characterized by small sample sizes and selection effects. For example less healthy former industrial employees might not have the same chances of becoming re-employed compared to their healthy counterparts. In the same context, the short duration of follow-up of those studies does not allow for long-term effects. Short-term effects usually have focused on mental health issues, whereas physical effects acquire a more long-term approach (Morris and Cook, 1991). Therefore, it is necessary that further research should unravel the distinctive nature of short and long-term associations of deindustrialization on

mortality variations. More precisely, a study to contrast the role of recession and industrial decline on the formation of mortality patterns by comparing countries that have experienced industrial contraction.

To summarize, first the literature has elaborated on the negative and positive consequences of industrial decline on morbidity by implementing mainly ecological and qualitative studies (Murray et al., 2005; Ostry et al., 2001; Walsh et al., 2010a,b). Second, unemployment, inactivity and re-employment (industries or other sectors) are the main routes, identified in those studies, of deindustrialization impacts on the health of the population. However, they have considered these causal paths separately and not simultaneously examined their impacts on health. Thirdly, most of those studies have mainly explored single cases such as individual countries, industries or occupational groups and mainly male employees, lacking the nature of comparison. Finally, the importance of the element of time has been often neglected in past studies. More precisely, a time-oriented approach, such as a distinction between short-term and long-term impacts of deindustrialization, can offer a more complete perception of how economic transitions influence morbidity and mortality.

Consequently, this thesis responds to those limitations of the contrasting, time dimension and the plethora of qualitative and ecological research not accompanied by information at micro and individual levels. Therefore, it contributes further to the current academic research by applying different methodological perspectives that operate in two levels, aggregated and individual. At an aggregated level, the purpose is to move beyond single cases and compare countries in order to explore the element of time. For example, to distinguish between the short and long-term influence of deindustrialization on mortality variations. This is achieved by controlling for country differences, national wealth as well as recession periods, when rises in unemployment are evident.

Likewise, the individual level of this thesis addresses the issues of time and comparison. By taking into account socio-economic attributes of individuals at a specific point in time, and following them in subsequent years, it offers a long-term approach of the health impacts of deindustrialization. Furthermore, this longitudinal approach contrasts individuals in different occupational groups. Also it simultaneously explores the health implications of their transition to unemployment, inactivity and re-employment in non-industrial sectors. Therefore, it offers the unique

possibility of identifying vulnerable groups of people. In addition to this, it examines whether undesirable transitions (unemployment or inactivity) can equally influence individuals of different expertise and gender.

Considering those dimensions, this thesis adopts a comparative approach and perceives deindustrialization as a multilevel uneven transition occurring across countries, regions and individuals. Most studies have explored single cases and dimensions, such as regions of a single country or specific population groups, such as former industrial male employees. Subsequently, the exploration of the association between deindustrialization and health, through the inclusion of a contrast across different levels, can offer important insights. For example, how some countries or individuals have been more susceptible to economic transitions than others.

Second, by reflecting on specific pathways, such as unemployment, inactivity and re-employment, already identified in the literature, it concurrently unravels the short and long-run implications of deindustrialization. Consequently, the second objective is the introduction of a time-related dimension to those pathways. Identifying the timing of those pathways can assist in a more complete understanding not only how but also when economic transitions influence morbidity and mortality. For instance, industrial contraction can be associated with negative health implications leading to rises in mortality, whereas in the long-term some of those effects subside. On the other hand, the reduction in employment of individuals, previously engaged in hazardous industrial environments, can demonstrate possible future positive health impacts.

Deindustrialization is a multidimensional and multilevel event and of course no single research can take into consideration all the possible mechanisms related to health and mortality at a national, regional or individual level. However, this research recognizes those complexities, tackles those issues and goes beyond the limitations of the present literature. Unraveling some of the methodological shortcomings can have important policy implications of how and when economic restructuring and transitions can influence morbidity and mortality. Understanding in more detail this association can assist in successful policy and health-related interventions on the individuals influenced by those transformations.

1.2 Aims and research questions

Deindustrialization forms an economic transition of advanced economies, constitutes a component of the economy as a whole, thus it is influenced by a country's overall economic performance. This transition has been a common experience of highly developed countries. However, its pace and duration are not equally distributed across space, countries, industries, or population groups. This thesis overcomes the shortcomings of the current literature; the lack of comparisons among countries and occupational groups as well as the lack of a distinction between short and long-term patterns of association. In order to overcome these limitations, this thesis has two aims.

Looking at the broad association of economy and mortality the purpose is to evaluate mortality variations by unraveling the long and short-term associations between deindustrialization and mortality at a national level. This results in the following research questions.

1 A. What has been the pace and timing of deindustrialization across Europe?

1 B. Is it possible to detect common patterns of industrial decline across different countries?

2 A. What is the relative importance of national economy, recession and industrial contraction on mortality trends?

2 B. Is it possible to identify the short and long-term patterns of association between deindustrialization and mortality?

On the other hand, case studies have mainly paid attention to distinctive industries or occupational groups. These studies have identified, as potential causal routes of health variations, the consequences of unemployment, inactivity and re-employment. However, those studies suffer from a lack of contrast and evaluation of long-term effects. Furthermore, the exploration of transitions from employment towards out of employment can have important health implications. Therefore, it is possible that certain population groups have been more vulnerable towards industrial contractions. Thus, at an individual level, the intention is to assess and contrast the health differences among employees who have undergone unemployment, inactivity and re-employment into similar or different sectors. It is expected that health disparities exist between those employed in the industrial and service sectors.

The subsequent research questions, which will be addressed in chapter 6, are:

3. How do transitions between employment statuses (unemployed, inactive and re-employed) affect health at an individual level?

3 A. Is there any difference on the health effects of being out of employment between individuals previously employed in the industrial and service sector?

3 B. Are there any health variations of employees moving between and within sectors? For example, changing occupation in the same sector or transferred from industries to services and vice versa.

1.3 Structure

The first chapter of this thesis has briefly outlined what is already acknowledged in the theoretical framework and the inadequacies of the literature so far. This thesis challenges those limitations by applying a different methodological approach that explores the main causal mechanisms already identified in other studies. After addressing the aims and research questions, this section summarizes the contents of the subsequent chapters.

The second chapter gives a framework and critical evaluation of the academic literature concerning the various pathways of the association between industrial decline, health and mortality. The review progresses at three different levels: national, area and individual. This is important since the complicated nature of deindustrialization can influence, through diverse mechanisms, the well-being of the population at different levels.

The first section provides an overview of some examples of industrial decline at an international level and briefly explores the case of the United Kingdom and Scotland. The second theme assesses the current literature of the broad association between cyclical variations, health and mortality. It also addresses issues concerning the occupational positive and negative health implications of the working environment of industrial and service sectors.

At a regional level, this thesis is directed towards the distinctive and dynamic role of the industry within the community as a contributor in the formation of social cohesion. Finally, at an individual level, the review outlines the possible impacts of industrial decline via unemployment, inactivity and re-employment.

The third chapter focuses on the methodology and implications of including aggregated and individual level secondary data together with the issues associated with comparative research. Due to the multidimensional nature of deindustrialization, the empirical chapters use different methodological approaches and address the substantive research questions. In more detail, the fourth chapter has a comparative character since it aims to identify deindustrialization periods across Europe and distinguish between different types of deindustrialization. The following chapter, using aggregated data, examines the trends of industrial decline and recession periods in relation to different causes of mortality. Furthermore, it looks in more detail at the overall association and short-term relationships between industrial decline and recession on suicides and all-causes of mortality.

The sixth chapter, by including individual level data, examines the occupational changes and employment patterns of former industrial employees compared to those in the services. In particular, this chapter assesses the potential health effects regarding different occupational groups through the route of occupational change, unemployment, inactivity and re-employment. The seventh chapter provides a short summary of the previous chapters, identifies the strengths and limitations of the study and synthesizes the evidence. Finally, it discusses the dynamics of deindustrialization at national, regional and individual levels and presents ways of how this research could be further enhanced.

Chapter 2

Literature Review

2.1 Introduction

This chapter offers a synopsis of the prevailing academic literature associated with the relationship between industrial decline, health and mortality. The first section provides a summary of the economic implications of industrial decline, such as the closure of industries, by displaying comparatively several countries that have undergone this process. The subsequent sections outline and evaluate the studies exploring the mechanisms of this connection. This is achieved by detecting and distinguishing those mechanisms (unemployment, inactivity and employment) at national, regional and individual levels. At a national level, special attention is given on the association between economic events and mortality as well as the role of the welfare state as a mitigating factor against the negative consequences of those events. This chapter looks at the health implications of employment in various sectors of the economy such as industries and services.

At a regional level, this section discusses the importance of place in the formation of health. It mainly explores the role of the industry, not only as an employer, but as a contributor of social cohesion and cultural identity within a region. At an individual level, this chapter discusses the health implications of unemployment, inactivity and employment. Finally, the purpose of this chapter is to achieve a critical evaluation and understanding of the achievements and limitations of present research.

2.2 Deindustrialization across space

There is not a single widely accepted definition of deindustrialization. It is normally considered as the contraction and decline of the manufacturing sector and calculated in relation to output (its total or relative value) and/or employment (total or relative number of employees) (Pike, 2009). Regarding decline, economists suggest that deindustrialization should be defined as *"a sustained decline in both the share of manufacturing and in total"* (Tregenna, 2008). A strong debate also exists concerning the determinants of deindustrialization. The causes of deindustrialization have been defined by implementing a range of approaches, which portray different explanatory aspects of this process.

Throughout the literature, the domestic main causes of deindustrialization are concentrated on the absolute and relative reduction in size and productivity of manufacturing and the shift in the population's pattern of consumption from manufacturing towards service-based goods. Furthermore, specialization, through technological innovations, can cause less labour intensive industries in advanced economies. In addition, globalization and trade can have a separate effect on deindustrialization, through direct investment to other countries and the import of manufactured goods from less developed countries (Nordhaus, 2005; Pitelis and Antonakis, 2003; Rowthorn and Ramaswamy, 1999; Alderson, 1999).

Deindustrialization is characterized by extremely imbalanced geographies and uneven historical progression in time and space. Different countries and areas have undergone deindustrialization in varying degrees and timings influenced by socio-economic characteristics of labour, political decisions and institutional legacies. At a European level, the United Kingdom, Belgium, the Netherlands and Denmark have been the first countries to experience this event. Areas such as North East Scotland and South Wales in the United Kingdom, Lorraine and Nord Pas de Calais in France, the Ruhrgebeit and Saarland in Germany, Wallonia in Belgium, Jutland in Denmark and Limburg in the Netherlands have been identified as de-industrialized (Pike, 2009).

Throughout the early 1970s until mid-1990s, deindustrialization has unfolded across southern Europe as well, affecting areas such as Pas Vasco in Spain and Setbal in Portugal. The manufacturing value added share in the GDP declined from 20% in the mid-1970s to almost 13% in the 1990s in Greece (Pitelis and Antonakis, 2003;

Pike, 2009). The most severe decline occurred in the United Kingdom, where almost 2 million jobs were lost (Kitson and Michie, 1996). After the late 1970s most European countries followed the path of industrial decline along with the recession periods of the mid-1970s and 1980s. This resulted in massive job losses and termination of factories that led to the deindustrialization of regions.

The initial industries affected by this process are the mining sector followed by iron and steel production, shipbuilding, textiles and clothing. In the case of shipbuilding, the Swedish shipbuilding industry has been successful until the 1970s; however in 1987 the most important shipyard in Malmo closed down (Poulsen and Sornn-Friese, 2011). The demand for sophisticated cruise ships, ferries and cargo vessels as well as the collaboration with the Soviet Union, resulted in a thriving ship building industry in Finland, which kept its importance until the year 2005. The iron, steel and shipbuilding industries have suffered the most in southern Italy in areas such as Campania, Puglia and Sicilia (Anderson et al., 2001). In the United States the textile industry lost most of its labour, whereas the coalfields in Yorkshire have suffered the largest decline in employment. Total employment in the coal industry has been reduced from 220,000 to 7,000 between the years 1981 and 2004 (Beatty et al., 2007; Raphael, 2012).

The formation of a Single European Market, the Economic Monetary Union and the collapse of communism accelerated the process of deindustrialization in the countries of Eastern Europe. This process of transition has been rapid, imbalanced and heterogeneous, since industries supported by the Soviet trading system are faced with international competition. The diverse progression of deindustrialization in Eastern Europe caused instant increase of the service sector in Czech Republic, Hungary and Poland. However, Moldova, Romania, Ukraine, Russia and Bulgaria faced an acceleration of employment in agriculture and a slow increase in the services (Pike, 2009).

In a more global perspective, in the United States, there has been a relocation of industries from the initial industrial lands of the north and east (Michigan, Pennsylvania) towards southern states (Arizona and New Mexico) and Los Angeles. This occurred due to the demand for low cost labour, productivity and taxes offered by the southern states. Furthermore, a second shift occurred in the context of the North American Free Trade Agreement (NAFTA), where the former industries of the North, East and South have been relocated in Mexico (Pike, 2009).

Through the 1990s industrial decline was apparent in Japan especially in Kanagawa, Osaka, Tokyo and Saitama. South Korea and Taiwan have also been affected (Edgington, 1994). Reduction in steel and motor vehicles industries has also been prominent in Australia. Finally, the city of Sao Paolo in Brazil saw the relative reduction of manufacturing in GDP and employment between the years 1990 and 2003 (Morris, 1996).

In summary, deindustrialization is a combination of various positive and negative internal and external factors that varied across countries and time intervals. Industrial decline has progressed unevenly beyond the borders of the advanced Western economies. It has become a more global event that will influence in the future even more developing countries in Africa and Asia; a phenomenon called *"premature deindustrialization"* (Dasgupta and Singh, 2006). There is an extensive variance concerning the characteristics and determinants of this phenomenon. Consequently every country, region and locality has been shaped uniquely in time and magnitude by different political and economic incidents at a national and international context. Since part of this thesis considers Scotland as a post-industrial case, the next two sections briefly oultine some of the determinants of deindustrialization in the United Kingdom and Scotland.

2.3 Deindustrialization in the United Kingdom

After the elections of 1979, the Thatcher era indicated the start of various economic transformations aiming at privatization and extensive industrial reforms. According to Kitson and Michie (1996) the shift of employment towards the services sector cannot be exclusively justified due to the change of consumption patterns or the labour demands of other sectors. The slowdown in the production of manufacturing in the 1980s occurred during a period of mass unemployment. It has been rapid and not accompanied by the expected absorption of the labour shed from manufacturing to the service sector (Rowthorn, 2000).

This combination of policies and reforms operating at macro and micro economic levels led to this result. More precisely, the limited investment in industries, the overvalue of Sterling, in an attempt to avoid inflation, and overall monetary policies have contributed even further to the fast pace of industrial contraction. In particular,

the conflict between the application of supply-side industrial policies and obstructive demand-side policies has worsened the position of manufacturing (Kitson and Michie, 1996).

During the 1980s the high interest rates hindered investments in firms. That led to the bankruptcy of many industries, hence the decrease in exports. In the same context, the transfer of interest in exports from manufacturing to non-manufacturing goods and the overall change in the United Kingdom's specialization patterns constitute the two major dynamics of deindustrialization (Rowthorn, 2000). In combination with the North Sea oil, all these factors have been the leading forces that quickened this transition and led London to become the centre of this change.

The recession of the 1980s, the inclusion of monetary policies and the lack of funds resulted in a geographical division in the United Kingdom, the so called *"north-south divide"* (Beatty and Fothergill, 1996; Beatty et al., 2007). Within this division the northern parts of the UK experienced low economic performance extensively influenced by the manufacturing contraction, whereas the south attracted the expansion of the service sector (Rowthorn, 2000). A striking example of industrial contraction has been the coal industry. The coal industry has been the most important industry in the United Kingdom since the 1920s and it has been reduced, during the 1980s, only to occupy 10% of the workforce. The coalfields of Yorkshire, Durham and Northumberland in North East England as well as the coalfields of Scotland have been affected to a great extent (Beatty and Fothergill, 1996).

Considering those industrial places, various regeneration policies have attempted to provide additional jobs in those areas that have demonstrated high unemployment. At a European level, the European Union (via the Reconversion Economique des bassins Charbonniers - RECHAR programme) has encouraged the regeneration of post-industrial areas (Beatty et al., 2007). This was achieved by providing financial assistance for the regeneration of infrastructure and business support. A UK example has been the British Coal Enterprise that aimed at the creation of job-related incentives. These policies had initially positive consequences. However, the continuing and extensive necessity of those regeneration plans led to the gradual reduction of financial generosity (Bennett et al., 2000).

In the end, the UK has been a unique case of deindustrialization for two reasons. The overall economic uncertainty since the late 1970s has been more severe in the

UK compared to other European countries. Secondly, the labour shed from the manufacturing sector did not accompany an increase in production and these displaced employees were not engaged in the service sector. Those service jobs often created in other areas of the country demanded different skills and usually absorbed individuals outside industries (Rowthorn, 2000). The following section explores briefly the case of Scotland, which has been most affected by deindustrialization.

2.4 The case of Scotland

As it was mentioned in the previous section, the northern parts of the UK have been disproportionately affected by the neo-liberal and monetary macro-economic policies of the conservative government during the 1980s. More precisely, Scotland and Glasgow, in particular, used to be prominent industrial centres of heavy industry such as iron and steel production, ship building and coal mining (MacInnes, 1995). Consequently, industrial contraction led to high levels of unemployment and inactivity resulting in high levels of poverty especially in the region of West of Scotland.

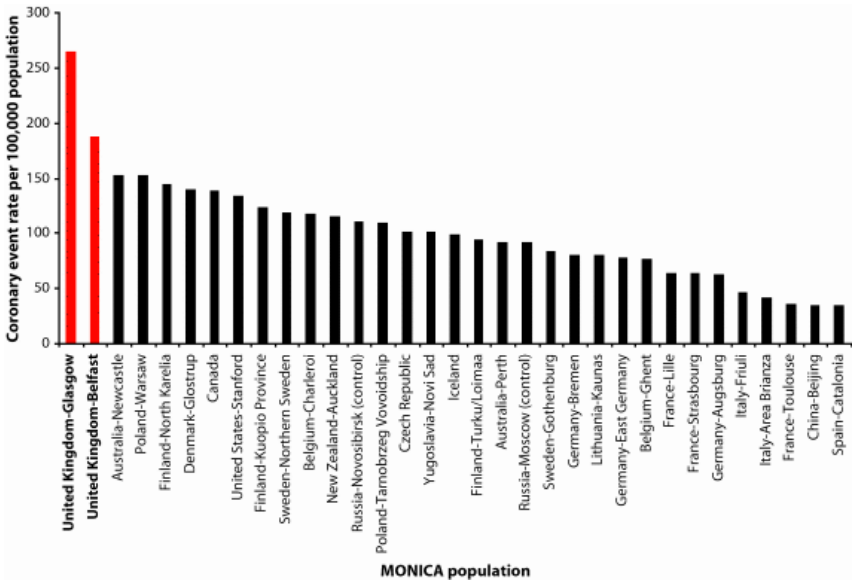
Scotland has been an interesting and distinctive case of industrial contraction for two main reasons. First, at a UK level, morbidity and mortality in Scotland and especially in the West of Scotland and Glasgow have been elevated compared to other equally deprived regions (McCartney et al., 2012b). Furthermore, there is an increasing gap in life expectancy between the most and least deprived areas followed by a rise of 9.5% in premature mortality between the years 1991 and 2001 (Norman et al., 2011). In addition to that, a study from Bell and Blanchflower (2007) showed that the Scottish suffer from worse physical health and high mortality from liver disease and lung cancer. Self-assessed morbidity, depression and suicide incidents are still higher compared to other parts of the UK.

Second, at an international level, Scotland still suffers from higher mortality compared to other European countries sharing similar industrial paths (Walsh et al., 2010a; Taulbut et al., 2013). This has led to the characterization of Scotland as the *"sick man of Europe"* (McCartney et al., 2012b). The figure 2.1 (p.15) presents the elevated incidents of cardiovascular disease in the male population of Glasgow compared to other localities. However, this has not always been the case, where

mortality in Scotland has started to deteriorate rapidly during the 1980s especially for external causes such as alcohol, drug-related deaths and suicides (McCartney et al., 2012b; Dibben, 2009). The relative poverty is also higher in the West of Scotland which leads to higher inequalities. A study conducted by Leyland et al. (2007) explored age and gender specific mortality in Scotland. Findings revealed that the excess in male mortality in Clydeside region has been concentrated on areas with the highest deprivation. Relative inequalities have increased for both genders and have been most noticeable in the ages of 30 to 49.

However, deprivation has not been adequate in explaining this elevated mortality (Hanlon et al., 2005). In the case of self-reported health, the excess is explained by socio-economic and occupational differences (Popham, 2006). Therefore, the elevated and unexplained mortality and morbidity in Scotland, not explained by deprivation, is named as *"Scottish effect"* (Hanlon et al., 2005; Bell and Blanchflower, 2007).

Figure 2.1 *International comparison of coronary event rate in MONICA (WHO Multinational Monitoring of Trends and Determinants in Cardiovascular Disease) populations (Males)*



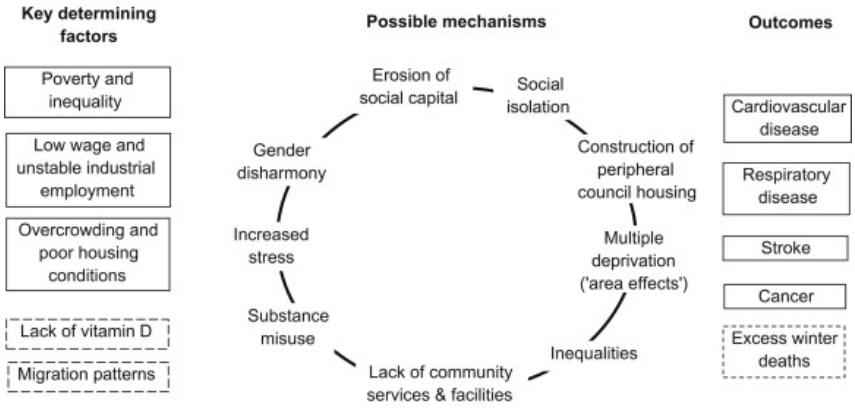
Source (Leon et al., 2003, p.22)

The wider income inequalities in Scotland and especially in the West of Scotland, named also as *"Glasgow Effect"* (Taulbut et al., 2013), have led to three main dimensions of causation: deindustrialization, the consequences of neo-liberal policies

(*"political attack"* hypothesis) and a set of unexplained factors that contributed to this low health performance. It has been suggested that the West of Scotland has experienced a more intensified deindustrialization compared to other parts of Europe and the UK (McCartney et al., 2012a). The macro-economic policies mentioned in the previous section, the so called *"political attack"* hypothesis (Taulbut et al., 2013), led to the uneven disempowerment of the industrial environment. This subsequently affected the population in Scotland through high levels of unemployment, inactivity and erosion of community.

The following set of figures 2.2 (p.16) and 2.3 (p.17) present the determining factors and mechanisms responsible for the elevated mortality in Scotland. More precisely, economic determinants such as low income, poverty and inequality together with lack of vitamin D and migration patterns have created various pathways that have contributed to this elevated mortality. For example, area effects such as erosion of social capital, lack of community services as well as overall deprivation are only a few of the possible pathways that are responsible for the elevated Scottish mortality.

Figure 2.2 *Simplified representation of the synthesis of the cause of the divergence of Scottish mortality from the rest of Europe from 1950 onwards.*

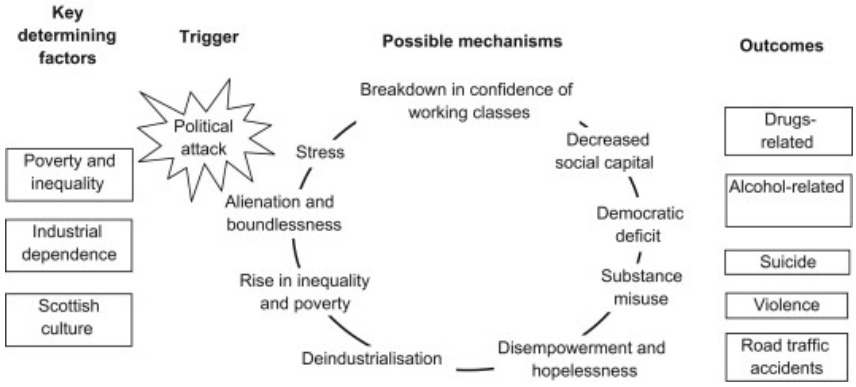


Source (McCartney et al., 2012a, p.465)

In summary, various monetary policies, such as the liberalization of the markets and the privatization of state-owned firms, together with the deregulation of the labour market and businesses reduced the strength of the unions (Rowthorn, 2000). Scotland has been a post-industrial region and part of the UK, therefore it has been affected by neo-liberal policies, wider economic inequalities and higher vulnerability towards those policies (Taulbut et al., 2013). Beyond deindustrialization and

politically-driven causes, several explanations have been given for the excess mortality, such as deprivation (Hanlon et al., 2005), migration, genetics and health-related behaviour as well as low levels of social capital, socio-economic conditions and climate (Gray and Leyland, 2009; McCartney et al., 2012a).

Figure 2.3 *Simplified representation of the synthesis of the cause of the higher Scottish mortality from 1980 and the Scottish effect.*



Source (McCartney et al., 2012a, p.466)

2.5 Industrial decline, health and mortality - association and pathways

From a national perspective, this section outlines the studies focusing on the association between economic fluctuations, unemployment and mortality. Furthermore, the role of the welfare state in mitigating the negative effects of unemployment is also discussed. This thesis hypothesizes that during recessionary periods it is expected that industrial contraction is more severe. That leads to higher unemployment, thus it can be possible to observe the acceleration of certain causes of mortality. Nevertheless, variations in social protections systems among countries can demonstrate a protective effect against downturns.

The second research aim is to explore whether occupational transition is beneficial for health for people engaged in industries and services. Therefore, the literature review contrasts the positive and negative health implications of being employed in the industrial and service sector. Moving forward, the issue of area effects of old

industrial regions is also outlined together with the importance of an industry for ex-industrial communities. Deindustrialization is more than an economic restructuring. Especially at an area level, employment in industries offered a sense of belonging and contributed to the formation of identity for the residents living in these regions.

Finally at an individual level, this thesis explores the health implications of the routes of unemployment, inactivity and re-employment into other sectors that involves engagement in less-desired jobs. More precisely, when it comes to employment, low-job satisfaction that occurs through skills mismatches can be associated with physical and mental health deterioration.

2.5.1 Aggregated level - economy, unemployment and mortality

Deindustrialization has existed separately to other macro-economic events such as recessions. However, industrial decline is an event that is influenced by a country's entire economic performance and it shares similar characteristics with recessions. Industrial decline is a transition that has occurred in many countries around the world; however this thesis hypothesizes that the timing, duration and magnitude of its occurrence have not uniformly influenced every country. The main negative impact is high levels of unemployment and insecurity similarly to cyclical downturns. Nevertheless, it is constrained to specific population groups and sectors, compared to recessions that are extended towards all the sectors of a country's economy.

Another significant difference is that deindustrialization is more constant compared to recessions that last for shorter time periods. During recessions, when overall employment declines, it can be expected that employment in manufacturing declines more rapidly compared to economic upturns. Thus, the main question that rises is whether deindustrialization can produce similar mortality patterns to recessions through the unemployment route.

According to the academic literature, at an aggregated level, many researchers hypothesize that cyclical upturns can benefit health by minimizing the negative effects associated with economic insecurity, whereas economic recessions can have severe effects on the population health (Brenner, 1971; Bunn, 1979). Using time series data Brenner (1971, 1975) suggested that there is a countercyclical relationship between economic downturns and mortality due to cardiovascular disease, suicide, homicide,

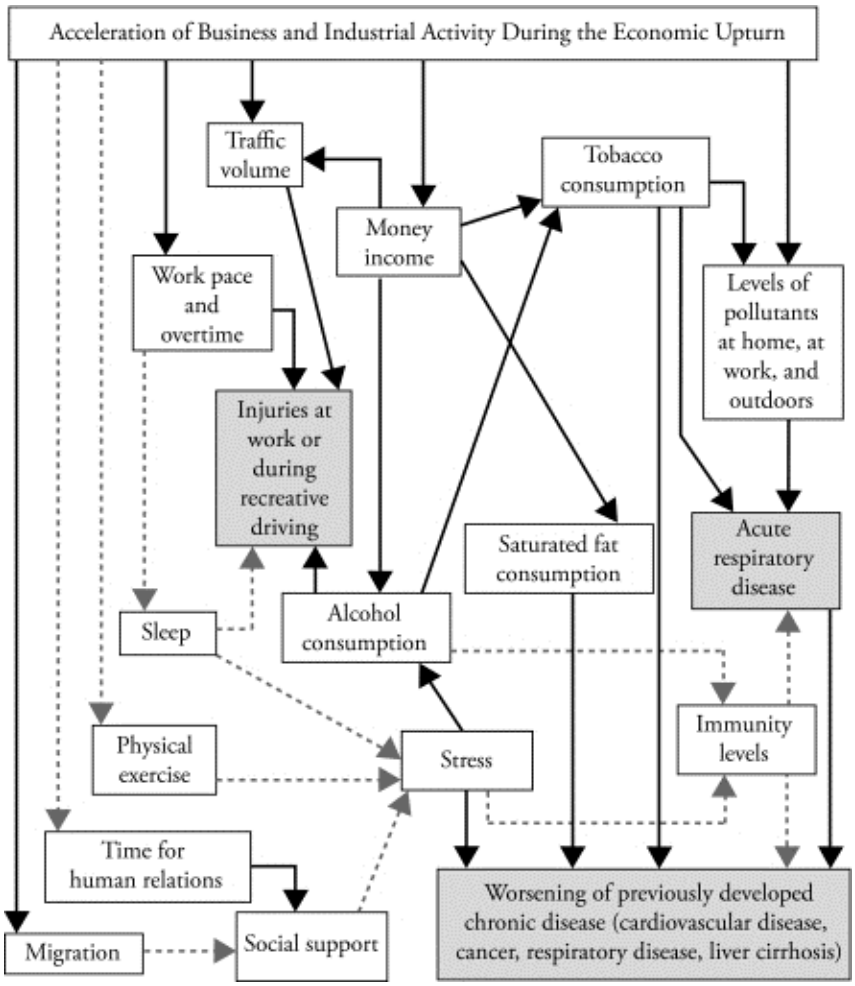
as well as infant mortality. In this case, a countercyclical relationship exists when there is a negative association between economy and mortality (Suhrcke and Stuckler, 2012). For example, during recessions, when the economy is weak, there is an association with rises in cause-specific mortality. The opposite of countercyclical is pro-cyclical, when there is a positive relationship between economy and mortality variations. However, studies conducted by Brenner have been criticized due to omitted variable bias, misspecifications and data irregularities (Gravelle et al., 1981; Wagstaff, 1985; Laporte, 2004).

More recent research, using also time series data, contradicts the previous negative consequences of recession. Studies by Gerdtham and Ruhm (2006) and many other scholars (Svensson, 2007; Stuckler et al., 2009a; Neumayer, 2004) revealed that cyclical downturns are related to the reduction of certain causes of mortality excluding suicides. Nevertheless, economic growth can be health damaging in the short-term revealing a pro-cyclical relationship. This was particularly strong for certain causes of death such as cardiovascular and liver disease, influenza and pneumonia, including external causes of death such as motor vehicle crashes (Ruhm, 2000). On the contrary, suicides and homicides are found to be countercyclical, whereas Neumayer (2004) found a pro-cyclical pattern. Therefore, there is a great diversity in the present literature regarding the association between economic fluctuations and mortality.

Contemporary findings are not consistent for all causes of mortality and different causes provide different associations with business cycles. According to Ruhm (2000, 2003, 2005) this occurs due to the fact that, during cyclical downturns, individuals change their lifestyle especially unhealthy dietary habits and increase their leisure time. In conjunction to the above, individuals reduce smoking and drinking-related behaviour because of financial constraints. This is also accompanied by a reduction of working hours especially in harmful working environments.

The Figure 2.4 presents the causal pathways of economic upturns and mortality. During economic growth, a combination of several environmental and psychological determinants might accelerate the worsening of a pre-existing disease. For example, according to Granados (2008) atmospheric pollution, work-related stress, lack of sleep and social relations as well as unhealthy behaviour and diet are more evident during economic upturns.

Figure 2.4 *Potential causal pathways linking economic fluctuations to mortality*



Source (Granados, 2008, p.396)

A subgroup of other studies, applying similar techniques to Ruhm (2000), but using Swedish (Gerdtham and Johannesson, 2005; Svensson, 2007) and European data (Economou et al., 2008), did not find such a procyclical relationship between the business cycle and mortality. In accordance with Gerdtham and Johannesson (2005) there is a countercyclical pattern between business cycles and cardiovascular, cancer and suicide mortality. For men this association is stronger especially for suicides. Another study by Economou et al. (2008) examined the effects of unemployment rates on age and cause-specific mortality. They observed a strong positive relationship between unemployment and ischaemic heart disease, cancer of trachea and lung, malignant neoplasms, homicide, suicide and self-inflicted injury.

Further studies have also distinguished between the short and long-term effects of recession periods. It has been hypothesized that the short-term health benefits of cyclical downturns can be offset by negative long-term effects. For example, although Ruhm (2000) observed that economic growth can be health damaging in the short-term, however in the long-run, if economic growth is sustained, this effect can be counterbalanced. Nevertheless, negative GDP fluctuations are connected with an increase in mortality especially due to suicides, together with unemployment and especially the fear of job loss (Stuckler et al., 2011; Perlman and Bobak, 2009).

A potential explanation of those above mixed outcomes according to Suhrcke and Stuckler (2012) and Stuckler et al. (2009b) can be due to the nature of recession. They suggest that a distinction is necessary between normal and more severe business fluctuations. Most studies exploring the association between economy and mortality are based on standard economic fluctuations, whereas more acute recessionary periods can reveal different patterns of morbidity and mortality.

The hypothesis that normal and severe business downturns can be associated with different patterns of mortality and morbidity can be observed in the the current recession in Europe and the United States. Regarding Europe, recent studies have shown that the consequences of severe recession expand beyond the rise in suicides. More precisely, outbreaks of infectious diseases, such as the human immunodeficiency virus (HIV), have become common in countries such as Spain, Portugal and Greece (Karanikolos et al., 2013). It is hypothesized that this occurs due to the interaction of austerity measures and economic shocks that lead to weaker health care systems.

In the United States, a study exploring the impacts of the current recession, showed that there is a positive association between unemployment and suicides among middle-aged males and females (Phillips and Nugent, 2014). In addition to that, higher female labour participation is related to higher female suicides, since the exposure to the negative impacts of unemployment is more evident. Nevertheless, a protective effect against suicides is observed for states with more manufacturing jobs and higher per capita income. They concluded that employment opportunities, especially for the working class, as well as a more prosperous context can alleviate the adverse consequences of severe economic downturns.

In conclusion, it seems that business cycles influence mortality by accelerating certain causes of death while minimizing others. Nevertheless, three basic elements are important: magnitude, duration, short and long-term associations. More precisely, it can be suggested that the higher the magnitude and duration of economic downturns the higher the increase of certain causes of death. In parallel to this, it can be argued that further studies are necessary in order to distinguish between short and long-term associations, since likewise different mortality patterns might be revealed. If that is the case with recessionary periods, it can be hypothesized that the association between industrial decline and mortality might also be affected by these elements. Could it be the case that the transition from industry to services can be health-damaging in the short-term but beneficial in the long-term?

2.5.2 Recession, unemployment and the welfare states

In the constant effort of scholars to assess the relationship between business cycles and mortality, significant attention is paid to the element of the welfare state in explaining health variations at a comparative level. Although, there is not a single and widely acknowledged definition of the welfare state, nevertheless it has been extensively used in order to describe the main social security and welfare protection systems of a state. In more detail, it includes a state's contribution to the main domains of social provision and protection such as education, housing and public health services (Eikemo and Bambra, 2008). Comparative public health research, based on the distinctive role of the welfare state, has led to various attempts at classifying different countries, with similar social provision characteristics, in broad regimes.

One of the most popular efforts is Esping-Andersen's typology based on three main concepts: decommodification, social stratification and the private-public mix (Esping-Andersen, 1990). By taking into account 18 OECD countries he concluded in three broad regimes: Liberal, Conservative and Social Democratic. In the Liberal regime benefits are limited, means-tested and provided through specific and restricted criteria. In the Conservative regime, previous earnings define the amount of benefits provided and depend on previous employment. The final regime is the most universal and characterized by substantial benefits and aims at the promotion of equality, full employment and income protection (Bambra, 2007).

Nevertheless, Esping-Andersen's typology has been critically assessed by other scholars. From a theoretical perspective, scholars have addressed the necessity of a separate Southern and East Asian regime. Furthermore, this initial typology ignores gender issues such as the position of women and the role of family in the formation of welfare provision and social stratification. In the same context, the typology neglects the element of education, social services and healthcare (Bonoli, 1997; Ferrera, 1996; Castles and Mitchell, 1993; Bambra, 2006).

From a methodological aspect, the main criticism is concentrated around the issues of the structure of the decommodification measurement, the choice of index weighting, the implementation and inaccuracy of the mean and standard deviation. The above limitations resulted in the creation of various other typologies that take into account the above considerations. Finally, special attention is given to the validity of the typology; welfare states are comprised by dynamic components and their nature is not static, thus typologies may not adequately capture the differences and similarities between countries (Bambra, 2006).

Beyond the above debates, several studies have demonstrated that the welfare states have a separate effect on health, since they influence the level of universality of social security towards the population of different socio-economic groups (Lahelma and Arber, 1994; Bambra and Eikemo, 2009; Bezruchka, 2009). Welfare state typologies have been previously used in order to explain health variations among countries. According to Navarro et al. (2006), Chung and Muntaner (2007) citizens living in welfare states that are more inclusive and universal tend to show lower mortality rates and better health compared to welfare states with less inclusive social security systems.

Another study by Bambra and Eikemo (2009) examined the relationship between unemployment and the risk of morbidity and mortality. By using the cross-sectional European Social Survey for 23 European countries, results demonstrated higher rates of poor health among the unemployed in all countries. However, relative inequalities were largest in the Anglo-Saxon, Bismarckian and Scandinavian regimes. They concluded that the negative link between unemployment and health is a common characteristic of all welfare state regimes. However, variations of this relationship among these regimes indicate that the level of social protection is significant.

Several studies have also explored the social protective role of the welfare state as a mitigating factor against the harmful health effects of business cycles. A comparative study by Gerdtham and Ruhm (2006) suggested that countries with strong safety nets can alleviate some of the negative implications of recessions. In addition, Stuckler et al. (2009a) explored the impact of economic changes on 26 European Union countries starting from the 1970s. Results showed that short-term and rapid escalations of unemployment were strongly associated with a rise in premature deaths such as suicides and homicides. They concluded that active labour market programmes could minimize some unfavourable health consequences of rapid economic fluctuations.

Furthermore, Kangas (2010) focused on the role of economy and welfare state on life expectancy by including 17 OECD countries from 1900-2000. The paper showed that financial prosperity is important for longevity but not sufficient in the long-term. The welfare state's generosity, broad social protection coverage and universal access are vital elements for the life expectancy to increase. Furthermore, during economic contractions, the safety nets of the welfare states, as in the Nordic countries, could hinder the widening of health inequalities and protect disadvantaged groups during a period of labour market imbalances and structural changes (Lahelma et al., 2002; Kunst et al., 2005). Finally, the generosity and universality of social policies can be beneficial not only in mediating the negative effects of unemployment but also act as an intervening factor in blocking the social determinants of health inequalities (Lundberg, 2008).

At a national level, welfare states appear to play a protective role against the negative health effects of unemployment at least to a certain extent. Generosity and universality are elements that can act as a shield against poverty for disadvantaged population groups. Nevertheless, a strong debate exists of whether typologies can explain or adequately capture the role of the welfare state especially as a measurement against health inequalities. Welfare states cannot eliminate health inequalities and unemployment is not the only status that can have a severe impact on health. The next section moves from the health impacts of unemployment towards employment. More precisely, it explores the health implications related to the nature of employment and outlines the research focusing on the association between occupational engagement in industries and services.

2.5.3 Health effects of employment in industries and services

Beyond the possible protective role of the welfare state, socio-economic and health inequalities are prominent among different welfare states despite their degree of universality and generosity. Therefore, the level of generosity of social security is not always adequate in minimizing those inequalities. Several scholars have addressed the issue of occupational inequalities between white and blue collar employees. For example, it has been observed that individuals in white collar occupations demonstrate better health in comparison to individuals in manual occupations and the unemployed (Lahelma and Arber, 1994; Lecrec et al., 1990; Kunst et al., 1998; Rahkonen et al., 2000; Martikainen et al., 2004).

Socio-economic inequalities are not necessarily smaller for countries with inclusive and egalitarian socio-economic and health care strategies (Mackenbach et al., 1997). However, Mackenbach et al. (2003) suggest that the extending inequalities between upper and lower social classes could be also due to the growing mortality in the lower socio-economic groups. This is observed especially from mortality due to lung cancer, breast cancer, respiratory disease, gastrointestinal disease and injuries.

Occupational status, such as being employed and the nature of occupation, is the source of many elements that influence physical and mental health. Employment provides financial protection, leads to personal development, boosts self-confidence and protects from the negative effects of unemployment (Benach and Muntaner, 2007). Besides the significance of employment status, working conditions and type of work are important determinants of health. There is a rich literature on the association between mental and physical health effects of precarious working conditions and low-status jobs (Benach and Muntaner, 2007; Stansfeld and Candy, 2006).

Furthermore, temporal and flexible employment, stress-related factors, such as low control and high demands, as well as the overall disproportion between effort and reward demonstrate an additional contribution to the formation of ill- health (Kivimäki et al., 2002, 2003, 2006). A US study observed that the risk of suicide is higher among employees working in the industrial sector and low-paid occupations, especially in mining and construction industries as well as wholesale, retail and trade-related jobs (Kposowa, 1999). However, employees in transportation and manufacturing occupations reported an intermediate risk of suicide, whereas those in managerial and administration professions had the lowest risk.

Evident health and mortality variations exist within different sectors and types of occupational engagement. Additional factors influencing this association are concentrated on the overall working environment that encompasses elements such as work-driven demands, rewards, flexibility as well as general job satisfaction. The following section of the literature explores in detail the importance of the working environment and the health consequences of being engaged in the industrial and service sector.

Positive and negative health effects - employment in industry

The subsequent section outlines the health implications associated with the industrial working environment. It is well established the being engaged in the industrial sector is related to specific diseases of the respiratory system as well as to various malignant neoplasms that differ among industries and types of occupations within the industry.

In relation to the paper mill industry, employees are exposed to various harmful substances, such as hydrogen, chlorine dioxide and paper dust. Paper mill workers and maintenance employees demonstrate lung dysfunction with elevated respiratory symptoms. Furthermore, long-term exposure to these substances increases the risk of ischaemic heart disease and pleura mesothelioma (Torén et al., 1996; Langseth and Andersen, 2000). In addition, female paper production workers have demonstrated increased mortality from lung cancer (Andersson et al., 2010), whereas sulphite mill male workers have showed an excessive risk of brain tumours and asthma mortality (Andersson et al., 1998). However, another study examining the mortality of employees in a Scottish paper mill industry did not observe an increase in lung cancer incidents (Coggon et al., 1997) but observed a rise in lymphatic and hematopoietic cancer for employees working in the production department.

Among pelletizing and packaging workers in carbon black manufacturing industry, elevated incidents of lung cancer were observed for those exposed, through inhalation and dermal contacts, to substances such as Polycyclic Aromatic Hydrocarbons (PAH) (Tsai et al., 2001). Similarly, crop protection manufacturing workers demonstrated raised mortality due to neoplasms of pharynx, oesophagus, rectum, larynx, lung, lymphatic and haematopoietic system (Jones et al., 2009). Contrary to previous research, a cohort mortality study of carbon black workers in the United King-

dom did not demonstrate significant results for elevated lung cancer mortality (Sorahan et al., 2001) in relation to the cumulative exposure to carbon or the duration of employment. Concerning the mining industry, further studies have showed that underground miners are exposed to high levels of radioactivity (Fox et al., 1981) and demonstrate high risks of lung cancer, while even underground ex-miners have elevated risk of chronic bronchitis (Hedlund et al., 2006).

Exposure to asbestos has been widely recognized as a very harmful substance responsible for elevated risk of lung cancer, peritoneal, pleural cancers and mesothelioma (Hein et al., 2007; Pira et al., 2005). A study in Great Britain, assessing the asbestos-related deaths from 1980 to 2000, found that lung cancer due to asbestos has probably accounted for 2–3% of all lung cancer deaths among asbestos workers (Darnton et al., 2006). Furthermore, respiratory system-related cancers, leukaemia, mental disorders, diabetes, epilepsy and injuries/poisoning were observed for workers exposed to dust, fumes, or vapour (Wingren, 2006; Alder et al., 2006). This occurs especially for those employees being engaged in the compounding/mixing, milling and maintenance departments of rubber tire manufacturing industries and petroleum distribution departments (Wingren and Axelson, 2007; Sorahan et al., 2002). Finally, construction workers demonstrate high risk of accidental death as well as various malignant neoplasms and cardiovascular diseases (Dong et al., 1995; Groeneveld et al., 2008).

On the other hand, various studies have identified the positive effects of industrial decline in relation to the reduction of occupational risk. A study conducted by Ostry et al. (2002) investigated the possible positive effect of deindustrialization on a random sample of sawmill workers in the province of British Columbia (Canada) in terms of self-reported health and working conditions. Deindustrialization reduced 60% of the sawmill industries between 1979 and 1998. By controlling for age, education and unemployment duration, among other factors, results showed that employees who left the industry reported better health and working conditions compared to the workers who stayed in the industry. Similarly, Loomis et al. (2004) examined the effect of deindustrialization on long-term occupational risk in the United States. They discovered that the occupational injury rate declined 45% from 1980 to 1996. Deindustrialization contributed to the decline of fatal occupational injuries in the United States, but explained only 10-15% of the total change.

Another study examining the changes in occupational injury between 1980 and 1989 (Stout et al., 1996) found that changes in work practices and environments, including increased regulations and hazard awareness, technology and mechanization contributed to the reduction of injuries. For example, as employment shifts towards retail and services industries, which have lower fatality rates, overall and demographic-specific fatality rates are likely to decline. Furthermore, a study, assessing the psychosocial and physical conditions of sawmill workers after the downsizing of the industry (Ostry et al., 2000), showed that downsizing removed 60% of the labour force. This resulted in a reduction of physical demand, especially for managers and skilled production workers, and psychological demand among unskilled workers. Furthermore, job strain has also been reduced, whereas social support remained unchanged indicating an overall improvement in psychosocial conditions.

In summary, although in the past, employment in industry has been extremely hazardous for physical well-being, nevertheless effort has been made to decrease the unsafe elements of the industrial sector. Most of the studies exploring the health effects of employees dismissed from industries are mainly qualitative and focus on single industries. Those studies have demonstrated certain health benefits for those who changed employment. Nevertheless, research should take into account that health variations exist among occupations within and between industries. Therefore, diversities in the health benefits of individuals absorbed in other sectors are likely to be observed for employees in different occupations and industries.

Positive and negative health effects - employment in services

The following section outlines the positive and negative health implications of being absorbed in the service sector. One of the most low-paid occupations in services is the wholesale and retail sector, where high rates of occupational deaths are observed for those working in petrol stations and convenience stores (Anderson et al., 2010). Furthermore, incidents of coronary heart disease are more prevalent in lower grade civil servants who are characterized by higher blood pressure, smoking and limited physical activity (Van Rossum et al., 2000). On the contrary, highly-paid employment is associated with reduced mortality especially for men (Detre et al., 2001).

In terms of the psychosocial work environment, elevated levels of job strain, high demands combined with low control and support, as well as long hours, can contribute to the rise for physical and psychological symptoms such as coronary heart disease, sickness absence, job and overall life dissatisfaction (North et al., 1996; Stansfeld et al., 1995; Sekine et al., 2009; Kuper and Marmot, 2003). Furthermore, job demands have a separate effect on health behaviour such as an increase in smoking intensity for men and women and high fat intake especially for men, whereas job latitude is associated with physical exercise for both genders (Hellerstedt and Jeffery, 1997).

Another study exploring the psychological health of high and low reward jobs demonstrated that low reward at work is associated with elevated risks of overall burnout, health complaints and emotional exhaustion. In addition, the combination of low rewards and high pressure at work is related to overall emotional negativity and imbalance between work and personal life (Van der Hulst and Geurts, 2001). Less-skilled people and long-term unemployed who accept low-paid jobs have accelerated chances to obtain higher paid jobs in the future. However, this is not beneficial for already highly-skilled individuals who obtain low-paid jobs or if low-paid jobs are associated with low status (Knabe and Plum, 2010).

Further studies on civil servants have showed additional physical effects of sedentary jobs. A prevalence of headaches has been observed for civil servants such as secretaries and typists compared to more active employees. This occurs despite gender differences, socio-economic status and employment ranking (Espir et al., 1988). Likewise, low status jobs are related to musculoskeletal disorders and harmful health behaviour such as smoking and drug abuse as a potential way of dealing with stressful work. Employees involved in monotonous and stressful office activities are more likely to suffer from neck and shoulder symptoms as well as musculoskeletal disorders. All the above, combined with economic difficulties and emotional stress, can elevate the risk of chronic illness and muscle pain syndromes (Lundberg, 1999).

Finally, regarding temporary employment, health research has revealed that temporary employees tend to demonstrate higher psychological morbidity and higher risk of injuries but lower sickness absence (Virtanen et al., 2005). In the same context, temporary employees have few development opportunities, low control and less support from fellow colleagues and supervisors (Aronsson et al., 2002). In terms of

job insecurity, a longitudinal study, exploring the employed white collar men and women in the civil service, found that job insecurity is associated with worse self-reported health and increased levels of cholesterol, blood pressure and body mass index (Ferrie et al., 1998).

Furthermore, the loss of job security and chronic job insecurity is associated with elevated self-reported morbidity. A Finnish study examining the downsizing of government employees, during recession (1991–95), has indicated increased levels of ill-health, especially due to musculoskeletal disorders, for those remaining in the job even after downsizing (Vahtera et al., 1997). Among white collar civil servants, a study, assessing the health effects of occupational status after privatization, has shown that insecure re-employment and unemployment are associated with a rise in minor psychiatric morbidity, whereas being permanently out of work with longstanding illness (Ferrie, 2001). Past and present circumstances such as economic difficulties and household income (Martikainen et al., 2003) could also offer some additional insights on mental health variations among civil service employees (Laaksonen et al., 2007). However, increased levels of control and social support at work could mitigate those adverse effects (Johnson and Hall, 1988; Johnson et al., 1989).

In conclusion, social support, control, variety at work and the appropriate skill implementation contribute to higher levels of satisfaction and well-being. As with the employment in industries, working in the service sector has demonstrated certain health implications that vary according to the type of work within the sector. Nevertheless, those health implications differ between industries and services. Research so far has demonstrated that although engagement in the industrial sector can be detrimental to health, however not every occupation in the services is beneficial for health either. The combination of various physical and psychological factors plays a significant role in health variations across and within sectors.

This section has explored various issues associated with the relationship of the overall economy, health and mortality together with the positive and negative effects of occupational engagement in the services and industries. Beyond the importance of these elements, the subsequent section presents a different dimension of this labour market restructuring. Literature has extensively explored the implications of industrial contraction across regions. Although the empirical part of this thesis does not focus on the place effects, nevertheless it considers the contribution of those studies

in an attempt to understand the multilevel role of deindustrialization. Therefore, the next step is to look at the importance of the overall relationship between place and health as well as the significant impact of the industry on the coherence and unity of post-industrial communities.

2.6 Health and place - the relationship

The association between health and place has been extensively explored in theoretical and empirical grounds. The main debates are concentrated on whether the attributes of a place have an independent effect on the health of the residents or whether the socio-economic characteristics of the individuals living in an area or community determine health variations (Shaw et al., 2001; Duncan et al., 1995; Shouls et al., 1996; Congdon et al., 1997; Gatrell, 2005; Gatrell et al., 2004). In order to define this relationship is quite complex and includes many potential causal pathways and interactions between individual and area characteristics.

According to Macintyre et al. (2002) a distinction is essential between a compositional and contextual clarification of area health diversities. The compositional classification refers to the demographic, socio-economic and genetic attributes of the individuals, which can act as potential factors in elevating or mitigating the probability of not good health. The contextual distinction refers to the area characteristics such as air pollution, social capital and cohesion, access to social and health services. It generally refers to the physical, social and economic environment. However, it is argued that research on the relationship between place and health should not differentiate between context and composition since these two elements coexist and mutually reinforce one another. Therefore, their effects cannot be distinguished (Cummins et al., 2007).

Most of the current research suggests that individuals sharing equivalent socio-economic attributes demonstrate health variations according to the level of area prosperity they live in. At the same time, the health gradient between underprivileged and wealthy individuals can be more evident in more prosperous areas (Shouls et al., 1996). A longitudinal English study looking at the association between level of social deprivation in electoral wards and premature mortality revealed that excess mortality is explained by the accumulation of people with unfavourable individual

or household socio-economic conditions (Sloggett and Joshi, 1994). A study by Ben-Shlomo et al. (1996) also concluded that higher levels of deprivation lead to higher rates of premature mortality.

However, the characteristics of individuals are inadequate to explain the differences between areas. A qualitative Swedish study showed that the area level has an important influence on risk factors of cardiovascular disease (Sundquist et al., 1999). Respondents living in the most deprived neighbourhoods have elevated chances of being a smoker, engaging in no physical activity and being overweight when adjusted for individual socio-economic attributes (Diez Roux et al., 2001; Hart et al., 1997). In terms of mental morbidity living in less deprived areas can mitigate the risks of mental illness (Duncan et al., 1995).

Finally, research has identified some of the most important factors contributing to these variations: the material and ecological landscape and exposures, allocation of wealth, level of social and cultural capital (Macintyre, 2000; Popay et al., 1998; Bernard et al., 2007). Further area characteristics affecting self-rated health include unhealthy physical environments, low political engagement, high levels of unemployment, low access to transport and health services (Cummins et al., 2005). It appears that the relationship between area characteristics and health differentials is quite complex and functions in conjunction with the socio-economic attributes of the individuals. After this short introduction, the next section presents in more detail the association between health and place in relation to industrial decline.

2.6.1 Industrial decline - health and place

Academic literature has explored the role of the state and institutions in managing the restructuring of former deindustrialized regions. Scholars have attempted to explain the uneven development of old industrial regions by examining two main geographical shifts in the industrial scenery. The initial industries were centred on coalfields, which offered the supplies and resources for other industries such as steel and metal processing. The main characteristics of these lands were the dependence on large production factories and the reliance on unionized labour force (Hudson, 1994).

The first industrial relocation occurred when the concentration of these practices moved to urban areas in order to approach the market of labour and consumption. The second shift appeared in the mid-twentieth century, where the production was transferred abroad and that led to industrial decline. Old industrial regions are perceived as places that have undergone different types of *"lock-in"* such as economic, cognitive and political (Hassink and Shin, 2005). These types of *"lock-in"* can hinder places from regenerating the initial industrial configurations or developing new paths of economic restructuring through the implementation of more developed economic activities (Danson, 2005).

From the 1970s until the 1990s industrial decline was evident in most European countries, while England was facing a quite extensive regional restructuring and industrial downsizing. This was observed in sectors such as coal mining and this process resulted in high levels of unemployment and inactivity. Due to these labour market changes, these regions were characterized by an overall decline in social, economic and environmental conditions (Riva et al., 2011a).

In the same context, studies have addressed the role of industry within the community and the multilevel meaning of job attachment influenced by the past and present economic transformations. Beyond the adverse working industrial and physical conditions, the existence of an industry contributed to the material and social cohesion of the community by providing a respectable working status and a socially-oriented environment (Parry, 2003; Cummins et al., 2005). According to Power (2008), the community offered its residents a variety of social, cultural and leisure activities. These events led to a distinctive coalfield heritage comprised by unique music, dialect and language, as well as oral history.

Subsequently, industrial decline had severe implications for the residents of those communities beyond the labour market. One of the main consequences of industrial decline is financial strain that leads to out-migration (Wray and Stephenson, 2012; Stillwell et al., 1990). The lack of employment opportunities could not attract young people causing further deterioration of social capital accompanied by outward migration. Some ex-industrial employees were relocated with their families, whereas others preferred to commute. For those who decided to stay, they tried to adapt to the new economic era by either attempting to find new types of engagement or classify themselves as unemployed or inactive (Wray and Stephenson, 2012). Consequently, the socio-economic implications of industrial decline have

hastened the erosion of social cohesion for those who stayed or did not have the means to migrate.

As a result, this multilevel deterioration has been related to adverse health effects of those deindustrialized communities (Phillimore et al., 1994; Walsh et al., 2010a). The coal industry in Britain faced the most sharp decline compared to other industries (Beatty and Fothergill, 1996). By 2007 only six coal mines remained in production (Gore et al., 2007). Nevertheless, the relationship between deindustrialized regions and adverse health is not only a consequence of industrial decline. It contains further complex interrelated factors and processes that have affected future generations living in those communities. These regions have undergone severe income disproportions, breakdown of community and identity, erosion of socioeconomic structures and ties via in-migration and out-migration (Mitchell et al., 2011). Consequently, future generations growing up in these areas are described by inferior health behaviour such as smoking, alcohol, poor nutrition and low physical activity (Shucksmith et al., 2010).

A study using data from the ONS Longitudinal study observed that overall mortality rates among men and women were significantly greater in coalfield areas especially in Scotland, Northern Ireland and Wales compared to England (Fitzpatrick et al., 2000). In an international context, a comparative study (Walsh et al., 2010b), using aggregated data, explored the industrial employment and mortality across twenty European regions. Despite the comparison with the United Kingdom, Scotland had the worst health outcome trends with high mortality among young working males and middle-aged females.

In addition to the above, the levels of limiting long-term illness (LLTI) are higher than expected in coalfield areas given their socioeconomic characteristics (Wiggins et al., 1998). A study conducted in coalfield communities reported higher levels of limiting long-term illness compared to the national average, suggesting a *"coalfield effect"* (Riva et al., 2011b), even after adjusting for the social class composition of the communities. However, for mental health, there was little difference in the local profile of coalfield communities compared to England as a whole.

In conclusion, studies have illustrated that health variations exist between coalfield communities. The population is not homogeneous in those communities with certain industrial areas demonstrating worse health than others, thus additional health-

related issues exist (Riva et al., 2011b). Furthermore, according to Mitchell et al. (2000) the degree of deindustrialization and the individual's attitude towards the community have an independent effect on the health of the residents in those areas. Consequently, both individual and area characteristics influence health, while the conditions of residential area in early life may help to explain the relatively poor health in some parts of Britain (Curtis et al., 2004). Considering those dimensions, these negative consequences of deindustrialization move beyond the undesirable effects of unemployment and inactivity that occurred in those areas.

Therefore, the next section of the literature review explores in more detail the consequences of industrial deterioration on individuals. Since deindustrialization resulted in high unemployment and inactivity at a regional level, the next part looks in more detail the health implications of this occupational status. As ex-industrial employees found employment usually in less-desired jobs, issues of job satisfaction and skill mismatches might have additional importance on the health of those employees.

2.7 Effects on individuals

During deindustrialization and regional restructuring, there has been a vast public and academic discussion concerning the end of an industrial society and the emergence of a service society. Despite the different theoretical approaches the main points are the following. First, there are different and multiple reasons that trigger industrial decline and restructuring such as international and national economic demands, labour market institutions and aggregated changes (Rowthorn, 2000). Sequentially, industrial reform causes unemployment, through the relocation of traditional labour patterns and a general skills mismatch (Beatty and Fothergill, 1996). Thirdly, the creation of new jobs, through regeneration policies, did not match in most cases the skills of the former industrial employees and those jobs were characterized by insecurity and dissatisfaction (Danson, 2005).

Furthermore, not every area has been capable of absorbing the labour shed from the industrial into the service sector, thus creating local and individual labour market inequalities. The following section goes beyond the area effects and discusses in more detail individual effects regarding the nature of employment, unemployment and inactivity. Within the nature of employment it is necessary to outline the im-

portance of two elements; job satisfaction and skill mismatches. These elements can co-exist in the work environment and be responsible for health implications. However, unemployment and inactivity do not occur uniformly across regions and individuals. The second research aim of this thesis explores the morbidity variations across individuals who get re-employed, unemployed and inactive. Therefore the last section of the literature review focuses on issues regarding re-employment, unemployment and inactivity.

2.7.1 Re-employment: Job satisfaction and skills mismatch

During deindustrialization, the change of traditional sectors caused inevitably the demand for new skill-oriented jobs, while former industrial jobs were fading. This resulted in an incompatibility between the expertise of former industrial employees and the requirements of the new status quo. Those skill mismatches gave rise to massive job losses and salary declines, especially for those at older ages, who could not meet the prerequisites of the new employers (Danson, 2005).

In this economic era, former industrial employees had limited possibilities of further employment especially in the low-skilled service sector, whereas those jobs were not similar to the skilled industrial occupations in terms of benefits, income and the overall nature of occupational demands (Wessel, 2005). This situation also led to high levels of job dissatisfaction especially for former industrial employees.

A plethora of studies exploring different aspects of job satisfaction have identified certain important job-related attributes. Those studies have focused on factors such as the establishment size (Idson, 1990), the educational level of the individual (Belfield and Harris, 2002), the low-paid service sector (Brown and McIntosh, 2003) and the level of effort at work (Green and Tsitsianis, 2005). Moreover, further elements, such as the level of job security and income (McCollum, 2013; Gazioglu and Tansel, 2006), the overall work environment, social support from colleagues (Dooley et al., 1987) as well as training and promotion opportunities, (Dickey et al., 2011) enhance overall job satisfaction.

When it comes to the employment of ex-workers, skill mismatches of former workers were evident during the re-employment process. Former industrial employees were more likely to be engaged in the retail sector that offered lower wages com-

pared to the industry and temporal employment (Wessel, 2005). According to Fallick (1996), displaced industrial workers are more likely to face earnings losses if they get re-employed outside their industry. In particular, if ex-industrial employees move to another region and change sector of employment compared to those who get re-employed in the same industry (Neal, 1995). Dislocation per se does not hinder re-employment but the labour demand for those skills and educational qualifications can be limited (Benedict and VanderHart, 1997).

In terms of health outcomes, employment itself can be beneficial for overall health, whereas high or low levels of work-related contentment can hinder or amplify health implications associated with the nature of the work environment. At the same time, a study (Ferrie et al., 1998) on civil servants demonstrated that job insecurity can have adverse health effects on the employees that cannot be explained by health behaviour. Likewise according to Ferrie et al. (1995) the anticipation of job loss or change in employment can lead to more severe ill-health. A one year follow-up study found that re-employment can contribute to emotional recovery similarly with workers who have stable employment (Kessler et al., 1989). However, a study by Rocha (2001) showed that ex-workers who become re-employed were facing a reduction in their salaries and some of them lost their health insurance, whereas overall financial strain was the main factor of depression and anxiety.

Although in general being employed is associated with better health, however when job quality is considered, the patterns become more complicated. Occupational engagement can be beneficial for health especially for employees working in healthy and safe environments. Low quality jobs with attributes such as high levels of insecurity, dissatisfaction and overall job strain are related to worse health compared to occupations with low levels of stress. In the end, re-employment cannot always mitigate the adverse effects of anxiety if financial stain remains.

2.7.2 Unemployment and inactivity

There are three main pathways concerning the link between unemployment and health. At first, employees suffering from ill-health are more likely to move towards unemployment (García-Gómez et al., 2010; Arrow, 1996; Lindholm et al., 2001). In the same context, unemployed suffering from poor health may have to remain in the same position for longer time compared to their healthy counterparts. Thus,

the likelihood of observing an individual with impaired health is higher for those belonging in the unemployed category. Finally, the transition from employment to unemployment may be health damaging for healthy individuals (Stewart, 2001; Bartley, 1994).

Unemployment, inactivity and re-training are the main choices of those workers not being able to be engaged outside industry (Fieldhouse and Hollywood, 1999). Economically inactive and unemployed are concentrated on the most deprived areas (Fone et al., 2007) that demonstrate increased mental morbidity, limiting long-term illness (Fone and Dunstan, 2006; Honkonen et al., 2007) and a higher risk of overall health deterioration (Brown et al., 2012). One of the immediate consequences of unemployment is financial burden. Financial distress is related to several indicators of emotional distress, including depression, anxiety and self-reported physical problems together with high levels of alcohol and tobacco consumption (Vosler and Page-Adams, 1996; Turner et al., 1991; Morris and Cook, 1991; Sullivan and von Wachter, 2009; Eliason and Storrie, 2009).

In addition to the above, various studies have demonstrated the issue of pre-existing ill-health, as an obstacle, hampering an individual entering the labour market (Schuring et al., 2007). Ill-health is a risk factor of becoming unemployed as well as remaining inactive and therefore increases the probability of early retirement. In the same context sickness absence amplifies the risk of job termination especially for employees in temporal jobs (Virtanen et al., 2005), whereas disability pensions were common among dismissed industrial workers (Westin et al., 1988). Overall, firms are more likely to dismiss older workers who are entitled to pension or some kind of social security (Koeber and Wright, 2001).

In summary, pre-existing ill-health as well as health-related behaviour can act as forerunners of unemployment and inactivity. Secure employment and satisfying working conditions can hinder the development of LLTI for healthy individuals (Bartley, 2004), whereas job insecurity increases the risk of LLTI. For the economically inactive, the transition towards employment can be beneficial for health, whereas young individuals and those with high socio-economic status are more likely to enter labour market (Popham and Bambra, 2008).

2.8 Summary

Summarizing, this chapter has outlined the research around the main possible pathways of the association between industrial decline and health. The literature review did not aim to analyze in depth the economic and historical implications of industrial decline but focused on the theoretical framework of the health-related consequences of economic transitions. Beyond the uneven pace and nature of deindustrialization across countries and regions one element is common; the health-related impacts of industrial decline occur at national, regional and individual levels. The figure 2.5 outlines the main conceptual framework of industrial contraction based on the existing literature. At a national level, the adverse effects of industrial decline can be accelerated via recessions causing further reductions in employment. As it was mentioned previously, economic transitions and especially short-term economic fluctuations can be responsible for the increase of cause-specific mortality such as suicides.

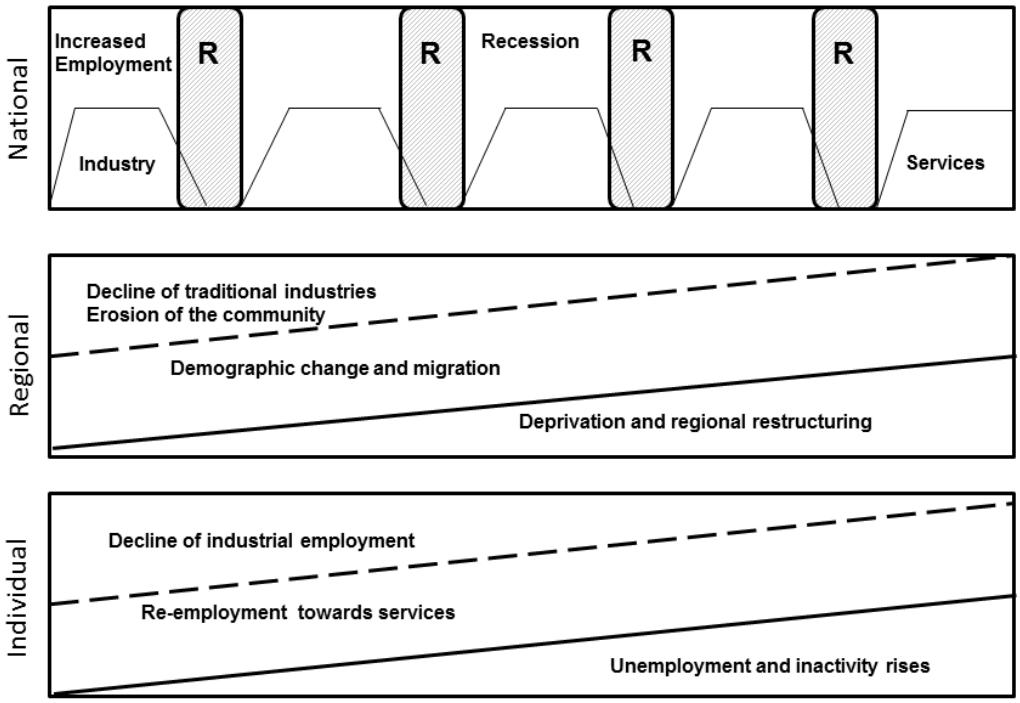
On the other hand, employment per se can also demonstrate health implications. Adverse working environments in heavy industries, such as mining, are associated with elevated risks of various malignant neoplasms and respiratory diseases. Therefore, it is expected that different departments in the industrial sector are associated with different health-related risks. Consequently, industrial contraction as well as technology in machinery accompanied by successful safety regulations can demonstrate some health benefits in the long-term. This occurs in two ways; by engaging ex-workers in more service-based jobs and by creating safer working environments. Nevertheless, the service sector is characterized by extensive diversity and can be associated with different morbidity outcomes. The variety of jobs within and across the different departments of the services creates further complexities regarding the identification of health outcomes. For instance, musculoskeletal and stress-related disorders are common among service sector employees.

At a regional level, this chapter has explored the concept of the industry not as an employer but as an element of a community. The association between a place and an individual has a dual direction. Individuals formulate the place they live in but also the place, as a physical and social environment, plays a role in the progression of community. Accordingly, the industry itself had the ability to connect individuals through the creation of a common identity, social ties and cultural events. The

timing of existence and the level of attachment of an industry are crucial elements. It can be suggested that the importance of an industry grows through time, since it acts as an employer and a formulator of identity for generations. Therefore, the severity of industrial contraction, the degree of deprivation together with the ability of an area's structural adaptation to economic transformations can hinder or quicken health-related consequences.

Finally, at an individual level, economic alterations affect individuals through the routes of unemployment, inactivity and the ability of re-employment in other jobs. The negative health effects of being out of employment have been extensively examined, whereas re-employment can be beneficial if the conditions of job latitude and equivalence of skills are satisfied. On the contrary, skill mismatches that result in overall job dissatisfaction can be associated with negative health implications.

Figure 2.5 *The multilevel nature of deindustrialization*



After Fielding (2010)

In the end this thesis suggests that deindustrialization should be conceptualized as an event appearing at different levels within a country and disproportionately shaping the health of the individuals. Thus, this review has developed the main issues associated with industrial decline and mainly progressed in relation to the research questions outlined in the introduction. However, the literature exploring the health implications of industrial decline has three main shortcomings. First, there is a limited number of comparative studies across countries and occupational groups. Second, most studies are mainly ecological (such as spatial, survey-based, aggregated) and qualitative, whereas individual level and gender information has been neglected. Third, there is a lack of the element of time and a distinction between the short and long-term impacts of deindustrialization.

Considering those shortcomings, this thesis has resulted in the following objectives. First, to examine comparatively the magnitude and progression of deindustrialization across different European countries that have experienced this decline and if possible to detect common patterns of progression. Second, to unravel the short and long-term association of industrial decline and mortality variations. Third, to evaluate and compare the health differentials among employees, who have experienced unemployment, inactivity and re-employment into similar or other sectors of the economy. Consequently, at a national level, the subsequent empirical chapters explore the association between deindustrialization and mortality by taking into account the concepts of recession and national wealth. At an individual level, this thesis examines the relationship between different employment statuses (unemployment, inactivity, re-employment) and morbidity by considering additional socio-economic and demographic factors. Before moving to those chapters, the next chapter discusses issues concerning the methodology of this thesis.

Chapter 3

Methodology

3.1 Introduction

The third chapter presents a methodological framework of this thesis. Initially, this chapter outlines the research aims regarding the association between economic transitions and health. It starts with the theoretical and methodological issues concerning the nature of research and causal inference. Next, it gradually discusses more specific and empirical considerations of various statistical techniques. Since deindustrialization operates across different levels, the empirical part of this thesis uses different data and more information about the datasets will be presented in the results chapters.

The aim of this chapter is to focus on higher issues of methodological considerations. The comparative nature of this thesis entails important dimensions (case selection, equivalence and causality) that should be addressed in order to successfully evaluate the strength and weaknesses of this thesis. Since this thesis includes panel data, the following sections are concentrated on the methodological strengths and shortcomings of inferring causality. The final part outlines various contemporary statistical methods (structural equation modeling, panel methods, matching estimators) commonly used to identify potential causal relationships.

3.2 Aims and data

As it was mentioned in the introduction, the broader aim of this research is to explore the health implications of economic transitions at national and individual levels. This is accomplished in two ways. At a national level, this thesis hypothesizes that industrial decline is not a totally independent event but also influenced by a country's economic upturns or downturns. Therefore, recessionary periods together with industrial contractions can influence the formation of mortality patterns across countries. The choice of countries included in this study is based on their mutual experience of industrial decline and are located in Europe. This is important because in order to include and compare countries in the subsequent analysis, it is necessary that they have undergone the transition from industries to services. Since the 1970s deindustrialization had already begun in Europe and this transition has been common in most countries, even though the magnitude and pace differs. Therefore, the following analysis in chapters four and five includes international databases (Organization for Economic Co-operation and Development (OECD), Structural Analysis Database (STAN), World Health Organization (WHO), United Nations (UN)) and a four decade period beginning in the year 1971. More details about the databases and the indicators will be presented in the next chapters.

The basic limitation of ecological (such as spatial, survey-based, aggregated) studies is that they do not take into account attributes of individuals and therefore cannot make any inferences at an individual level. This is important since the socioeconomic determinants among individuals can explain health variations of different population groups. In order to identify more precisely the effects on the population, this thesis incorporates individual level data. It takes into account the case of Scotland using the census based Scottish Longitudinal Study. Scotland represents the most deindustrialized region across the UK, thus it forms a good example of post-industrial region (Taulbut et al., 2013; Walsh et al., 2010b). The following analysis takes into consideration the routes of unemployment, inactivity and re-employment when exploring the relationship between industrial decline and morbidity. It is hypothesized that health variations occur among individuals shifting between different sectors of the economy as well as between in and out of employment. Since the nature of the initial aim considers different countries, the subsequent section of this chapter addresses the main considerations regarding comparative research.

3.3 Comparative research

3.3.1 Theoretical and methodological issues

Comparative studies present comparisons of social units and contexts containing quantitative and qualitative information across nations and regions. Most theoretical debates associated with comparative research exist between the positivism and radical relativism approaches. Positivism suggests that it is necessary to identify comparable social elements and facts in comparative studies, whereas relativism suggests that comparisons are not possible (Mills et al., 2006). In the first case, social events are common across societies and can be comparable through the inclusion of appropriate measurements (Smelser, 2003). In terms of radical relativism or *"cultural relativism"* as expressed by Benedict (1934) (as cited in Smelser 2003), none of these social phenomena can be compared due to the distinctive nature of every society and country.

Therefore, the main debates around comparative research are divided between scholars who aim to identify similarities, contrary to those who focus on variances across different frameworks. Quantitative comparative studies suppose that social events are based on universal patterns and regularities. In terms of the epistemological framework, the quantitative nature of this thesis follows a deductive approach, where research questions have been formulated by considering the current literature. However, there are certain methodological problems associated with comparative studies that are centred on four main domains: the case selection, the case versus variable orientation, the construction of equivalence and causality (Mills et al., 2006).

Case selection

There are two main approaches to analysis in comparative research, small-N and large-N case selection. Comparative large scale analysis aims to identify universal similarities and differences, whereas in the case-oriented approach the interest lies on the contextualised nature of systems (Mabbett and Bolderson, 1999). In this case, the population is most likely theory-driven thus the findings might favour specific research quests or include not relevant cases (Ragin, 1989; Mahoney and Goertz,

2004). Therefore in terms of the scale of the analysis the research has to decide between a small-N and large-N cases.

Studies with small-N but many variables might impose difficulties in sufficiently testing for causality. In contrast, when there are many cases with too few variables, then there is an elevated risk of producing superficial results. In the first approach, the case-oriented tactic implements many variables with few cases. On the contrary, the second approach tries to statistically explain variances with many cases but few variables (Pennings et al., 2006; Ragin, 1999). In the variable-oriented approach, the choice of cases is based upon reasons such as cultural familiarity, socio-economic attributes of the units and availability of the data (Ragin, 1997). Considering the issue of data availability, advanced economies, being members of international organizations (OECD, Eurostat), are more likely to participate in the accumulation of data for cross-country comparisons (Ebbinghaus, 2005).

There are various types of cross-country comparative studies. For example Kohn (1987) attempted to introduce four ways in which comparisons can be achieved and four different types of these studies. First, countries are the main focus of interest, where the researcher desires a deeper understanding of the countries. Second, there is a more context-based analysis, where the main focus is on a specific phenomenon across various countries. The third type refers to the unit of the analysis, when the aim of the research is to explore social phenomena in relation to other attributes of the countries. The last type describes transnational studies where countries are perceived as components of an international system (Baistow, 2000).

Another concern is the sampling in comparative research, which is one of the most significant issues to take under consideration. Macro-comparisons are characterized by within sample heterogeneity, thus violating the homogeneity assumption of inferential statistics. This can be minimized by controlling for unobserved heterogeneity; however, the inclusion of control variables can reduce the degrees of freedom. Therefore, these issues can be challenged by either selecting countries with similar conditions or suggesting similarity of countries belonging in the same groups or databases. However, the selection of countries due to a membership in an organization can lead to selection bias (Ebbinghaus, 2005).

In this thesis the methodology incorporates large-N cross-country comparative information and follows a variable-oriented approach. The source of information is

derived from databases, such as the Organization of Economic Corporation and Development (OECD), the Structural Analysis Database (STAN), the United Nations (UN) and the World Health Organization-Mortality Database (WHO). This choice is based on the availability of the data, since those sources constitute comprehensive tools for cross-country contrasts. More information about the databases is detailed in the subsequent chapters. As it was mentioned before, the choice of countries depends on their mutually shared industrial history and those units are concentrated on Europe. Although those countries experience industrial contractions, nevertheless the progression differs within every country. Furthermore, beyond deindustrialization, variations across entities exist in terms of their institutions, legislations and policies. Therefore, it is essential that this heterogeneity must be taken into account, since it is likely that those elements influence the exploration of associations. Various statistical methods, explained in the subsequent section of this chapter, can control for cross-country diversities.

Construction of equivalence

One of the issues of validity in comparative studies is to create instruments of measurement that are equivalent. Equivalence is a fundamental element of validity. According to Green and White (1976) a comparative study is valid when conceptual and functional equivalence has been achieved. Conceptual equivalence refers to two main issues. First that an event occurs in every country, being part of a potential study, and second that the conceptual framework of this event can be interpreted across countries and is not constrained only within a country. Deindustrialization has occurred in most advanced economies and, regarding the countries being analyzed, it has been ensured that this transition has happened to every country. Furthermore, although there has not been a formal definition of deindustrialization, it has been commonly interpreted as the contraction of manufacturing employment (Pike, 2009).

Secondly, conceptual equivalence can be problematic if functional equivalence is not accomplished. In particular, if the measurement implements concepts that are not uniform across countries. The elaboration of measurements that are entirely valid and reliable is a difficult task. Additional caution is necessary in order to choose measures that examine the same phenomenon in each country. However,

even if a single measurement is functionally and conceptually valid, it is likely that a phenomenon is displayed differently across countries (Mills et al., 2006). The researcher could minimize these limitations by selecting a nationally representative sample for every country that is as comparable as possible. As it has been discussed, deindustrialization has progressed differently across countries revealing diverse magnitudes and timings. Nevertheless, the sources stated in the previous section aim to achieve comparability across entities when measuring concepts such as labour market (unemployment, employment) and mortality. Furthermore, the sample is derived from official registrations and refers to the whole population.

For various contexts or attributes of concepts to be comparable, it is necessary for certain dimensions to be common even when country variations exist. The nature of equivalence can refer to various dimensions such as policies, systems, institutions, linguistic concepts such as social services, welfare state and community. Thus, it is quite challenging to achieve national homogeneity and be able to generalize within a country (Baistow, 2000). Since absolute equivalence rarely occurs a researcher should be able to recognize the within country variations and evaluate to what extent those variations influence comparisons across countries (Sekaran, 1983). Additionally, concepts are not static but change over time, evolve beyond national borders and are also affected by historical, political, cultural and economic processes within the country. Finally, although unconditional uniformity cannot be accomplished, the intention is to achieve the highest degree of conceptual and functional comparability in order to successfully determine associations.

Causality in comparative studies

Unraveling the puzzle of causality has always been a major challenge in comparative research. This section outlines the two main approaches of defining causality. The positivist approach supported by (Goldthorpe, 2000) discusses the achievement of causality in three stages. It is necessary to establish social uniformities at the macro-level, via statistical techniques. Second, the formulation of hypotheses assists in the understanding of the primary mechanisms producing those regularities. In the final stage, the mutual regularities may contain uncommon elements, which do not appear systematically but can reveal a common pattern (Mills et al., 2006).

On the other hand, the approach introduced by Ragin (1997) suggests the reconsidering of the assumptions of quantitative research. He suggests that the distinction between independent (cause) and dependent variables (effect) must be conceptually reformulated. More precisely, the linear and additive effect of independent indicators on the dependent variables should be reconsidered as a more combined feature of certain conditions that produce a specific outcome. This can be accomplished in two ways; by assessing cases with common outcomes and detect mutual causal conditions or by including cases with common causal conditions and detect similarities in the outcomes pattern (Mills et al., 2006).

In terms of epistemological and ontological positions there is a controversy between deterministic and probabilistic causality (Lieberson, 1991). Small-N comparisons are characterized as deterministic, since one case can ignore the possibility of events occurring by chance and the likelihood of measurement errors. However, a probabilistic approach supports the ontological interpretation that social practices are complex and stochastic, whereas small-N studies cannot control for all the possible relevant interactions that can intervene and influence social processes (Ebbinghaus, 2005). Cross-country contrasts in this thesis adopt a probabilistic approach and follow a more positivist causal framework. The aim is to reveal common patterns and regularities across countries by controlling for the complex mechanisms that influence the formation of social processes and economic transitions.

3.4 Panel data

The current thesis utilizes observational panel data. The analysis occurs at macro and micro-levels, where different information is obtained across countries and individuals. The data representing the countries are defined here as repeated (or time series) cross-sectional, whereas data on individuals are longitudinal. The previous section explored the issues associated with macro-level comparisons using panel (repeated cross-sectional) data. This part of the methodology discusses the issues associated for both micro-individual level data as well as macro-country level repeated cross-sectional data. Although both datasets belong to the observational panel data category, nevertheless they are certain differences.

The main advantage of longitudinal research is that it consists of *"a variety of methods connected by the idea that the entity under investigation is observed repeatedly as it exists and evolves over time"* Nesselroade and Baltes (1979) as cited in (Frees, 2004, p. 25). Longitudinal and repeated cross-sectional data are comprised of a cross-section of subjects (countries or individuals) with a time dimension. They both offer repeated observations on subjects detected over time. An important advantage of longitudinal and time repeated cross-sectional data, compared to only cross-sectional or time series data, is the capability to examine dynamic associations and to model variations (the element of heterogeneity) across subjects and time. Longitudinal data has an additional advantage, since it is more appropriate in detecting changes not only across but also within individuals, whereas repeated cross-sectional studies do not have this ability. This is achieved by following the same individuals over time and therefore is more appropriate in exploring causal associations (Martin, 2013). Nevertheless, panel data contains certain considerations that must be taken into account in order to identify causal relationships (Frees, 2004).

3.4.1 Methodological considerations of panel data

During longitudinal analysis the basic assumption and concern is the omitted variables bias, where the model does not control for the unobserved variables that might influence the dependent variable and explanatory variables, thus the distinction between a cause and effect is not feasible (Frees, 2004). In order to overcome this, effort must be made to include information for as many variables as possible that can influence both the treatment and exposure. However, sometimes it is uncertain which indicators affect the treatment and outcome variables, therefore those should be taken under consideration during the analysis.

Another drawback of longitudinal data is the attrition bias when the longitudinal data does not meet the basic sampling design requirements, which means when subjects progressively do not response. This can be a problem since selection bias can occur, when a not at random selected sample is used (Frees, 2004). This is not a concern for the repeated (or time-series) cross-sectional data that represents countries, since data comes from large databases (OECD, WHO, UN, STAN) that collect information from governmental bodies and are constantly updated. In the

case of the SLS the initial sample is followed up only twice and individuals not appearing in the second time frame are excluded from the sample.

3.5 Correlation and causation

3.5.1 Theoretical Approaches

The concept of causality has given rise to strong debates among philosophers related to its definition and existence. In the mid-eighteenth century Hume (1993, section VII) as cited in Marsh and Elliott (2008) claimed that causality appears *"if the first object had not been the second never had existed"*, suggesting that if the cause does not occur, the outcome will not occur either. Other philosophers proposed that the concept of causality can be implemented only in everyday life and in sciences that are in early stages (Russell, 1913) as cited in Marsh and Elliott (2008). An attempt of defining causality would be to suggest that *"causes are processes which, once started, end up producing a specific outcome at a later point in time"*, thus if x causes y, then a change in x will also cause a change in y (Marsh and Elliott, 2008, p. 237).

Nevertheless, if one event precedes another this does not sufficiently create a causal association between them. Especially when examining social phenomena, there are complexities in explaining events, thus many different components can act together when producing an outcome (Ringer, 2002; Marsh and Elliott, 2008, p. 238). During these complicated processes numerous factors can act together to generate an outcome and those factors can be causally connected with each other. There are two main approaches when attempting to identify causal relationships among social phenomena, structural individualism and methodological localism.

In structural individualism there is an association among factors operating at macro and micro-levels, where the impacts of macro factors are identified by disaggregating the effects at micro-level (Coleman, 1990) as cited in (Little, 2012). This approach considers actors as occupants of positions and they construct associations that depend upon these positions. These associations are interrelated and result in a structural effect. Regarding methodological localism, the human beings are active and gain their attributes via social institutions and organizations. They es-

tablish interactions and networks with other individuals. They comprise institutions and organizations and establish structures at different levels. Thus, causal powers should be attributed to social constructions at a variety of levels. There are three main groups of sociological frameworks of causality (Coleman, 1986). At first, the dependent variable is explained by independent variables at the same level, such as individual or country level. In the second group, the level of the dependent variable is explained by covariates occurring at a higher level. In the final group, variation in the effects at one level is explained by changes at a lower level (DiPrete and Forristal, 1994).

In the same context, there is an actor-centred view where the whole society is formulated by the activities of socially-located actors. Social phenomena are centred on actions of individuals, thus there are possibilities for causal inference since individuals connect causes and effects via their actions (Little, 2012). In terms of understanding various social processes, the element of time should be defined, when individuals act. More precisely, it is necessary to identify the earlier and current conditions under which individuals act and the aims they are trying to achieve, via their actions, at a particular time. Furthermore, in order to specify the anticipations directing the behaviour and future actions of people, causal inference should also consider the element of free will of individuals. However, when aiming at identifying causal associations, via statistical models, these methods can only generalize and detect common elements or patterns of behaviour but not determine behaviour (Blossfeld and Pötter, 1999).

The methodology of this thesis aims to determine associations and possibly causal associations though the implementation of appropriate statistical methods. However, social and economic phenomena are complex and are based on the combined interactions of various factors at micro and macro-levels. Quantitative studies cannot account for or explain all the interactions and determinants of social phenomena. This could not be achievable if the free will of the individuals is considered, thus it cannot be measured. However, statistical analysis used in this thesis will unravel some of the mechanisms operating across macro and micro levels, in order to observe some common regularities in countries and individuals. The next section presents various statistical techniques in detecting causal associations.

3.5.2 Statistical modeling and causality

Among researchers there is a common perception that causal relationships are based on randomized experiments but not exclusively on data. However, a shortcoming in inferring causality occurs since observational data do not derive from controlled experiments with random samples (Blossfeld and Pötter, 1999). Consequently, causality cannot be purely achieved by using observational data or statistical models but it is a sequence of deductions based on the theory of the occasional field (Frees, 2004). The necessity of a theory-driven hypothesis is a vital step before any causal assumptions are made. In particular, a hypothesis, driven from current knowledge about a subject, has to identify the theoretical processes of how a cause creates an effect in a specific time-frame. These theoretical underlying processes should influence the data collection, analysis and interpretation (Pötter and Blossfeld, 2001; Blossfeld and Pötter, 1999).

The first step of inferring causality is a statistically significant relationship and an association between two variables which is not due to an omitted variable. Additionally, the causal variable must precede the other variable in time. This indicates that the propensity of social entities to change their behaviour can affect changes in subsequent actions (Blossfeld and Pötter, 1999; Frees, 2004). However, there are certain issues that can hinder the inference of causality. For instance, researchers cannot identify and account for all the factors influencing causal relationships. Thus, scientists can only make probabilistic arguments of causation (Blossfeld and Pötter, 1999). Beyond the confounding bias, there are also measurement errors, selection and sampling bias, missing data and model specification errors (Greenland and Robins, 2009).

Statistical innovations can minimize some of the biases related to confounding and selection bias. There are three main methods of causal approach identified in the literature: graphical, structural equations and counterfactual (potential) outcomes. The graphical approach describes the classical approach of path analysis deriving from theory and outlining the possible pathways between variables. The main assumption is that one variable directly affects another one described by a single-headed arrow (Greenland et al., 1999). However, path models only suppose causation from associations in observational data, without being able to infer causality (Freedman, 2006).

Structural equation modeling is a multivariate method that combines factor and path analysis and the aim is to identify the direct and indirect relationships among observable and latent variables. It incorporates a group of methods such as covariance structure analysis, latent variable analysis and confirmatory factor analysis (Nachtigall et al., 2003). However, structural equation modeling is quite complex and requires a large sample size. The foundation for causal inference is counterfactual (Holland, 1986). The counterfactual analysis of causation is described as the application of treatment at one point in time and the observation of the effects on a subsequent outcome. It offers clarity related to the value of randomization and defines direct and indirect effects of variables (Greenland, 2000; Pötter and Blossfeld, 2001).

There are four quasi-experimental research designs providing approaches to causal inference using observational data: ordinary regression and panel methods, matching and reweighting estimators, instrumental variables and regression discontinuity methods (Nichols, 2007). In the regression and panel models confounding variables are measured in a direct way or are invariant across time or space. Those models should meet specific assumptions (linearity, normality, independence, homoskedasticity) and control for confounders (Freedman, 2006).

In matching estimators some observations are matched with the average of the other observations with identical treatment statuses in order to account for mismatches. The nearest neighbour matching method combines the observations in both treatment and control groups and then calculates the difference in the dependent variable for each combination and the mean difference across combinations. However, the main limitation is that this method is computationally intensive. Confounding can also be controlled for via propensity score matching which estimates the susceptibility of an entity to obtain a binary treatment and groups entities with similar propensities (Nichols, 2007). Accounting for pre-existing differences (dynamic modeling of latent difference scores, multilevel models, regression discontinuity) and the inclusion of instrumental variables can also control for selection bias (Larzelere et al., 2004; Nichols, 2007).

3.5.3 Fixed effects

As it was mentioned in the beginning of the chapter, observational panel data are used in the exploration of the health implications of economic transitions at a national and individual level. At a national level, cross-country comparisons are conducted with the inclusion of international databases providing various indicators of interest. More details for those indicators will be given in the following chapter. The information collected covers four decades staring from the year 1971 across fifteen European countries. This results in a time-series cross-sectional dataset (TSCS). At an individual level, the data originates from the Scottish Longitudinal Study (SLS) and covers two time frames 1991 and 2001. In the case of Scotland the interest lies on the comparisons across occupational groups (industries versus services) and across occupational transitions (unemployment, re-employment, inactivity).

The main difference between panel and time series cross-sectional data (TSCS) is that usually the general panel structure has a large number of units (large N) with every subject observed only a few times. Similarly, the panel structure provided by the SLS contains few time frames but many individuals. In contrast, the TSCS datasets demonstrate a large (or not) number of units with multiple time frames (Kittel, 1999). In this case, there are both short (many individuals few time points) and long panel (few countries and long time series). For the needs of the analysis at a national and individual level, fixed effects modeling is used, which is a special case of matching estimators.

The main advantage of panel data is the capability to explore dynamic relationships and to model differences among subjects. Fixed effects investigate the association between predictor and outcome variables within entities such as countries or individuals. Since the attributes of an entity may influence the predictor and outcome indicators, fixed effects have the ability to control for unobserved and time invariant characteristics and that is the main advantage. Thus, fixed effects are not suitable for exploring the association of variables that demonstrate very little within cluster variation (Frees, 2004).

Therefore, the choice of this statistical method is based on two main reasons. First, in every cross-country comparative research, variations across countries, such as institutional differences, public health and social policy systems, influence statistical associations. These are time invariant confounding factors that must be controlled

for in order to isolate any associations. These differences can be included by using county-specific slopes in the form of dummy variables. Second, fixed effects explore within entity (individuals or countries) variations, which is essential in examining annual economic transitions and mortality variations across longer periods of time. In the case of individual variations, fixed effects can assess the health implications of occupational and socio-economic transitions.

Assumptions

The following section outlines the main assumptions associated with fixed effects. For any causal inference to be made, the assumptions must be met. The main assumption of the fixed effects is related to the constant variance (homoskedasticity) across subjects. In this case information for different countries should vary differently. However, in one country, indicators can fluctuate widely, whereas in other countries remain relatively stable. Thus heteroskedasticity is a common element of this data (Cameron and Trivedi, 2005).

Secondly, indicators in various countries are assumed to be independent from each other. For example, economic performance in one country can differ in relation to what occurs in other countries. In statistical terms this is described as cross-sectional autocorrelation. Nevertheless, institutional changes do not have long-lasting implications on economic performances thus the intensities of these effects gradually disappear. Another assumption is that there is no correlation between the error term of an entity (individual or country) and the predictor variables. However, fixed effects allow for some form of endogeneity, where covariates can be correlated only with the time-invariant error term. Therefore, serial correlation occurs since the error term is correlated between different time points (Kittel, 1999).

Furthermore, time-invariant attributes are distinctive across country/individuals and should not be associated with other attributes of an entity. It is assumed zero correlation between time-constant variables and an entity's error (Frees, 2004). In fixed effects or within estimator, the idiosyncratic error is independently and identically distributed. Due to the fact that every entity (country or individual) is dissimilar, a country's error and time invariant attributes should not be correlated with other countries. However, this method permits correlation between time invariant and time varying covariates. Finally, independence over entities is assumed, however

for observations within a subject serial dependence is allowed. The independence (homoskedasticity and normality) assumption can be relaxed by using cluster robust standard errors (Cameron and Trivedi, 2005).

Limitations

The main advantage of fixed effects is that it controls for time invariant country attributes, which is necessary when institutional differences are evident and influence associations. However, as with every statistical method, there are certain limitations that must be considered. The main limitation of fixed effects is that it cannot explore time invariant origins of the outcome variables and are confined only in investigating changes within an entity. In the case of TSCS, the coefficients describe the combined average partial effect of time and space. Thus since the coefficients (time and space) remain constant no additional information can be obtained for these dimensions of cross-country variations (Kittel, 1999).

Fixed effects are sensitive to attenuation bias derived from measurement error, which usually changes from year to year. In the same context, fixed effects cannot control for unmeasured predictors that vary over time. Another issue is cross-sectional autocorrelation, which occurs when variables are assumed not to be independent from each other. Economic performance or institutional conditions can depend on events occurring in other countries and can lead to parallel deviations from the values of the dependent variables. Another limitation is that the error term is correlated between different points in time for every subject or country (serial correlation) (Kittel, 1999).

A common alternative to fixed effects is random effects. The main advantage of random effects is that time-invariant attributes can be included in the model as explanatory indicators. It assumes that the fixed element is uncorrelated with the independent variables and variations across entities are expected to be random. It is necessary to specify those time-invariant indicators otherwise this can lead to omitted variable bias. However, for the current analysis, fixed effects has been considered more suitable for two reasons. First, in cross-country research the randomness of the variations across units is a very strong assumption and is often violated. This method assumes that the time-invariant error is not associated with the covariates, which is frequently unlikely (Cameron and Trivedi, 2005; Baltagi, 2008).

Similar strategies with fixed effects are the deviation from mean, named as within estimator, where the residuals from a set of country dummies in a country/year panel are expressed as deviations from country means. An equivalent to fixed effects is the inclusion of the least squares dummy variable (LSDV). This is an ordinary least squares (OLS) regression with dummy variables and contains the usual assumptions of normality, independence and homoskedasticity (Kittel, 1999; Cameron and Trivedi, 2005).

An extension of fixed effects, named pooled effects, allows for dynamic analysis of cross-country and time variations. The assumption of pooled models is that the residuals are independently and identically distributed. If all independent variables are taken into account, there is no correlation with the error or dependence between entities. More precisely the model supposes that countries or individuals are identical and a single coefficient is estimated for countries and periods. However, pooling regression, without the inclusion of dummy variables, ignores unobserved heterogeneity (Baltagi, 2008).

Furthermore another method, differencing, is suitable when two or more periods occur. It assumes that homoscedasticity exists and there is no serial correlation in errors. Differencing and within estimators although minimize the omitted variables bias, however they remove potentially useful information. The inclusion of first differencing allows the error terms to be correlated with each observation. Likewise, the implementation of instrumental variables and lagged dependent variables as regressors can deal with measurement error issues. First differencing has the advantage of a weaker exogeneity assumption, by including one less year from data. This way it permits future values of the covariates to be correlated with the error (Cameron and Trivedi, 2005). Finally, the last section outlined some of the most common techniques for panel data. There are numerous other statistical strategies for panel data and of course it is not possible to refer to their advantages and implications in detail. After exploring those strategies the inclusion of fixed effects has been considered as the most suitable for the analysis.

3.6 Summary

This chapter outlined the main theoretical and methodological considerations associated with comparative research. The basic implications are concentrated on the selection of appropriate measurements in defining events, processes and outcomes. Secondly, social and economic phenomena include interactions of elements operating at different levels and across various dimensions. This thesis overcomes those complexities by including observational data that refer to macro (aggregated) and micro (individual) levels. For that reason each subsequent chapter explores different sets of research questions and presents different methods of analysis. Although this chapter has briefly described the data used in this thesis, it has mainly aimed at discussing the overall advantages and limitations of comparative research and various statistical methods.

From an empirical perspective, there is a great diversity among statistical methods commonly used for identifying causal associations in panel data. Those strategies contain their own assumptions, strengths and weaknesses. The fixed effects method has been considered the most suitable after taking into account the nature of the data and its diverse context. This strategy has the ability to control for unobserved time invariant attributes across entities (countries or individuals). This is vital since countries are characterized, for example, by institutional, social policy and public health differences that should be controlled for in order to isolate further associations. Although institutional and policy changes occur in every country, nevertheless those changes do not fluctuate as widely as the overall economy and their effects on economic performances are not ongoing or so intensive in the long-term (Kittel, 1999). Subsequently, those elements are perceived by fixed effects method as time invariant confounding factors. The next chapter is the first results chapter that explores the time trends of deindustrialization and mortality variations across different European countries.

Chapter 4

The progression of deindustrialization

4.1 Introduction

This first chapter of the empirical part of this thesis aims to explore the progression of industrial decline. It is hypothesized that industrial decline is characterized by uneven progression and severity across countries. This is important since this thesis assumes that the magnitude or severity of deindustrialization can be associated with mortality fluctuations, whereas periods of recession can have an additional effect on mortality trends.

Before the transition towards services, the industrial sector has been the main employer of most European counties. Therefore, during periods of recession, when unemployment rises, industrial contraction can be more severe and therefore influence mortality variations. In order to explore the nature of deindustrialization, it is necessary to adopt a comparative approach that illustrates in detail the timing and progression of this event. In parallel to this, an inclusion of a single approach that measures the magnitude of industrial contraction can detect potential common patterns of the severity of deindustrialization.

Due to the diversity of the current literature concerning the determinants and methodology of measuring industrial decline, it is essential to decide on a framework that meets the purposes of this chapter. The main interest lies on the country level industrial decline, triggered by internal policies and institutions, resulting in the growing

importance of the service sector. Thus, this thesis adopts the two-fold (positive versus negative) approach introduced by Rowthorn and Wells.

In the maturity argument deindustrialization is perceived as a positive transformation of the economically advanced countries. It is a natural evolution of mature and successful economies moving towards a service-based financial system. Therefore, employment in manufacturing declines, while employment in the service sector increases. In particular, Rowthorn and Wells (1987, p.5) perceive deindustrialisation as a *"the normal result of sustained economic growth in a fully employed, and already highly developed, economy [which] occurs because productivity growth in the manufacturing sector is so rapid that, despite increasing output, employment in this sector is reduced, either absolutely or as a share of total employment"*. This aspect of deindustrialisation has been named as positive or mature deindustrialisation, where the labour surplus from manufacturing can be absorbed by the services (Tregenna, 2008).

Contrary to the positive or maturity argument, the failure thesis or negative deindustrialization is the second argument identified in the literature. It covers three main aspects: loss of competitiveness, expenditure patterns and specialization (Rowthorn and Coutts, 2004). More precisely deindustrialization could be *"a product of economic failure and occurs when industry is in severe difficulties. Labour derived from the manufacturing sector - because of falling output or rising productivity- will not be reabsorbed into the service sector"* (Rowthorn and Wells, 1987, p.5), thus unemployment increases. The failure of manufacturing is caused by changes in expenditure patterns of the population. In advanced economies where the national incomes rise, the public expenditure patterns are altered towards more service - based goods (Rowthorn and Coutts, 2004). Furthermore, specialization in industries as well as advances in technology and competitiveness can contribute to the acceleration of productivity and at the same time create a demand for more sufficient, profitable, less labour intensive, highly-skilled industries. As a main outcome, less labour intensive industries reduce the amount of employees needed in the manufacturing sector (Rowthorn and Ramaswamy, 1997, 1999).

The first stage of the project addresses the issue that very few studies have measured the extent and magnitude of deindustrialization in a comparative perspective and distinguished between different types of industrial decline across countries (Tregenna, 2008). Therefore, this chapter has a dual aim. The first stage of this thesis

has recognized the lack of a single measurement that comparatively assesses the extent and magnitude of industrial decline. Thus, this is achieved by computing a single index to quantify deindustrialization.

Having decided upon the framework and computing the index the second objective is to construct a typology that differentiates between various categories of deindustrialization and subsequently allocates countries according to their industrial employment performance. Since industrial contraction is an event portraying uneven progression and intensity, a classification may provide an initial illustration of its severity across countries. This chapter concludes on two research questions:

1 A. What has been the pace and timing of deindustrialization across Europe?

1 B. Is it possible to detect common patterns of industrial decline across different countries?

4.2 Methods

The following section outlines the indicators used for the computation of the industrial decline index. Due to the comparative nature of this chapter, information is derived from databases of international organizations. Those databases offer comparability, detailed and complete information across countries, thus they form a necessary tool for comparative studies. The indicators included in the measurement are: employment in manufacturing, labour force and overall employment. The following table (4.1) outlines the data sources of the labour market variables together with the advantages and limitations of the databases. The following section provides more detailed information.

Table 4.1 *Data Sources*

Databases	**Advantages**	**Limitations**
STAN	Coverage	Limited detailed data
ILO, UN	Comparability	Possible inconsistencies
OECD	Accessibility	Lack of information

Labour Force Database of the Economic Cooperation and Development (OECD), Structural Analysis Database (STAN), International Labour Organization (ILO)- Laborsta Database, United Nations (UN).

4.2.1 Labour market indicators

Manufacturing employment

Although there is not a definitive terminology of deindustrialization, it has been frequently measured as the contraction of manufacturing industry in terms of output (total value of the sector) and/or employment (Tregenna, 2008; Pike, 2009). The data covers four decades of industrial decline starting from 1971 until the year 2009. The choice of this period is due to the fact that industrial decline had already started during the 1970s in most European countries. The choice of countries is also based on their historical framework of industrial decline briefly outlined in the second chapter. Since industrial decline has not happened in every country worldwide, thus it is necessary to include countries where industrial decline had already occurred. Furthermore, the interest lies in a specific time frame, the availability of adequate information and data has also contributed to the choice of countries.

Therefore, the main variable to capture both sides (positive and negative) of deindustrialization is the employment in the manufacturing sector. Industrial employment has been formulated in absolute or percentage terms. In particular, either as a total or/and as a share of total employment. This is significant because, in an expanding economy, manufacturing (output or employment) maybe declining in relative terms without losing its importance or size in absolute terms (Pike, 2009). Due to the comparative nature of the chapter, the index uses the share, defined as the ratio of employment in manufacturing to the employment of the total economy. However, absolute and percentage terms are also presented in the descriptive information for a more complete illustration of manufacturing contraction.

Information is provided by the Organization for Economic Cooperation and Development (OECD) Structural Analysis Database (STAN) and, in the case of missing values, the International Labour Organization (ILO)- Laborsta Database was used to include additional information (further information: (STAN, 2012). This database provides detailed structural analysis across countries. The thematic areas provide information regarding output, labour input, investment and international trade. Information is derived from annual national accounts as well as national industrial surveys and censuses. The inclusion of a standard industrial classification (ISIC) achieves comparable information across countries.

Likewise, the Laborsta Database includes labour market indicators collected from labour force databases, census information and administrative sources. This database covers over 200 countries starting from the year 1969 and it will gradually be replaced by ILOSTAT (further information: (ILO, 2014). For this project the industrial employment is categorized by the following classification: Manufacturing (D), which is based on the International Standard Industrial Classification of all economic activities 3rd Revision (ISIC Rev.3) (UN, 2014).

Additionally, the performance of the mining sector (C), which does not belong to the manufacturing sector, is included in the results. The mining sector has also been affected, therefore it will be interesting to observe its reduction in employment too. However, the contribution of the mining sector in the whole economy has been minor compared to the manufacturing sector. Most studies have mainly included the manufacturing employment in various measurements, thus it is not included in the index.

Labour force and employment

The reduction in employment either as a total or as a share of the labour force is the main outcome of negative deindustrialization. This indicator accounts for what Rowthorn and Wells (1987) named as *"failure effect"*. In this case, economic discrepancies along with the demand for more service-based skills can hinder other sectors of the economy from engaging the employees dismissed from the industries. Additionally, new cohorts entering the labour market might not have the opportunities of the past to get absorbed in the industrial sector due to the shrinkage of the labour force in this sector and the demand for new skills. The result is the shrinkage of employment or the increase of joblessness.

Employment data is obtained by the Labour Force Database of the OECD for the years 1971 until 2009 (OECD, 2011b). This database includes gender-divided information on labour force, employment and unemployment as well as comparative labour-related tables broken down by age for every OECD country. For the analysis the civilian labour force and civilian employment, excluding the armed forces, are included. The Civilian Labour Force Database includes all those in and out of employment who belong to the working age population (15-64) of every country in the analysis. Civilian employment includes all those in paid employment, with a job (if

they are attached to a job officially) but temporarily not at work (maternity leave, injury, illness), self-employed and employers (OECD, 2011a).

Recession

Numerous studies, exploring the association between economic decline and mortality, have used the Gross Domestic Product (GDP) as in indicator (Stuckler et al., 2008; Chung and Muntaner, 2007). For this thesis the GDP growth rate is applied to distinguish declining periods obtained from the United Nations national accounts. This database provides information on national accounts starting from the 1970s and covers more than 200 countries. The GDP growth rate is defined as *"ratios of total change in a specified time reference period to values at the beginning of the period or at a specified earlier time reference"* (UN, 2013).

4.2.2 Deindustrialization measurement

The creation of a single deindustrialization measurement is a combination of the indicators mentioned above. The purpose is to determine the timing and magnitude of this event and at the same time distinguish between positive and negative deindustrialization. Hence the time coverage begins from the year 1971 until the year 2009 and in this measurement fifteen countries are included: Austria, Belgium, Denmark, Finland, France, Germany (only West Germany until 1990), Greece, Netherlands, Norway, Ireland, Italy, Portugal, Spain, Sweden and the United Kingdom.

Step 1

Since the data regarding the employment in the manufacturing sector, civilian employment and labour force are in absolute terms, the first step is to calculate the percentage of employment in manufacturing and percentage of civilian employment. The choice between absolute and relative terms of employment indicators was based on the current economic literature. For instance, economists have recognized both the importance of employment in manufacturing (absolute and relative terms) and output (absolute and relative terms) in defining deindustrialization (Tregenna, 2008). However, the study is interested in the population's perspective and

labour market variations, thus the analysis uses manufacturing employment as a proxy of deindustrialization. Furthermore, there is also a fundamental distinction between the absolute and relative concept of employment in manufacturing.

More precisely, in an expanding economy manufacturing (output or employment) can be deteriorating in relative terms but not in absolute terms (Pike, 2009). A rising share of manufacturing in GDP can demonstrate a simultaneous decline in the share of employment if changes in this sector surpass the changes occurring in other sectors of the economy (Tregenna, 2008). Finally, the inclusion of relative indicators is based also on the attempt to maintain consistency with mortality rates, which are also computed for comparability reasons. Since the countries included in the analysis have an uneven distribution of population numbers, relative terms can provide more consistent results.

This is calculated as follows:

Input variables

$ME(n)$: Absolute Manufacturing Employment at year n (000s).
$CE(n)$: Absolute Civilian Employment at year n (000s).
$LF(n)$: Absolute Labour Force at year n (000s).

Percentage Manufacturing Employment (PME)

$$PME(n) = (ME(n) \div CE(n)) \times 100 \tag{4.1}$$

Percentage Civilian Employment (PCE)

$$PCE(n) = (CE(n) \div LF(n)) \times 100 \tag{4.2}$$

Step 2

The next step is to calculate the annual change in the percentage of manufacturing employment and percentage of civilian employment.

$$\Delta PME(n) = (PME(n) - PME(n-1)) \times 100 \tag{4.3}$$

$$\Delta PCE(n) = (PCE(n) - PCE(n-1)) \times 100 \tag{4.4}$$

Step 3

Since deindustrialization is mainly perceived as the reduction in manufacturing employment, therefore the creation of a single measurement should include only the time frame, when this reduction occurred. Furthermore, a decrease in manufacturing employment during a single year does not necessarily mean deindustrialization. In addition, calculating only the difference of employment in manufacturing between decades ignores significant information concerning the years in between. Thus, deindustrialization should be perceived as a sustained decline in manufacturing employment (Tregenna, 2008). However, there is not any definition in the literature to describe the time of sustained, therefore the measurement considers deindustrialization as the decline in manufacturing employment for three consecutive years.

To isolate the three consecutive years of decline in manufacturing employment the following equation is used:

$$CD(n) = 1 \tag{4.5}$$

when

$$\begin{aligned} \Delta PME(n) &< 0 \text{ and} \\ \Delta PME(n+1) &< 0 \text{ and} \\ \Delta PME(n+2) &< 0 \end{aligned}$$

else

$$CD(n) = 0$$

Equation (4.5) creates a new variable named *Consecutive Drop (CD)* and allocates the number 1 when the reduction in ΔPME is below zero for three consecutive years.

Step 4

Equation (4.6) creates a new variable named *Magnitude (M)* that indicates the magnitude of deindustrialization. For each year where $CD = 1$ (when employment in manufacturing was less than zero for three consecutive years) it gives the moving average over a three year window.

If $CD(n) = 1$

$$M(n) = \sum_{t=n}^{t+2} \Delta PME(n) \div 3 \tag{4.6}$$

else

$$M(n) = 0$$

Step 5

Equation (4.7) creates a new variable named *Employment Window (EW)* which calculates the moving average over a three year window based on the variable ΔPCE, see Equation (4.4).The variable EW could have values above or below zero indicating a rise or a fall in civilian employment.

$$EW(n) = \sum_{t=n}^{t+2} \Delta PCE(n) \div 3 \tag{4.7}$$

Step 6

The final Equation (4.8) calculates deindustrialization based on the variables *Employment Window* and *Magnitude*.

$$DZ(n) = EW(n) \times abs(M(n)) \tag{4.8}$$

For example in the year 1972 and 1973 in the United Kingdom the ME was 7,629,809 and 7,639,921 the CE: 24,139,000 and 24,715,000 and the LF: 24,917,000 and 25,272,000. The first step is to calculate the percentage of manufacturing employment and civilian employment for both years.

So for the year 1972 the PME =(7,629,809/24,139,000)x100 and PCE=(24,139,000 /24,917,000)x100 and the year 1973 PME=(7,639,921/24,715,000)x100 and PCE= (24,715,000/ 25,272,000)x100. This gives the following numbers: PME=31,61 and 30,91 and PCE=96,88 and 97,80. The second step is to calculate the annual change of PME and PCE. So ((30,91-31,61)/31,61)*100=-2,21% and ((97,80-96,88)/96,88)*100=0.95% .

The next step is to calculate the drop in manufacturing employment for three consecutive years. Therefore if the annual change of PME is below zero for 3 years,

then CD=1. For example, if 1978=- 0,78 and 1979=-2,16 and 1980=-5,29, then the moving average (magnitude) is -2,74. The same calculation of moving average is applied for the annual change of PCE. Finally, DZ= -0.17 x abs(-2.74)= -0.47. A case of negative deindustrialization.

This calculation provides two different outcomes: positive and negative deindustrialization (Table 4.2). In both positive and negative cases there is a sustained decline in manufacturing employment, when deindustrialization occurs. If this is accompanied by a reduction in overall employment then there is a negative case of industrial contraction. On the other hand, if the reduction in industrial employment follows an increase in overall employment then there is a positive case of deindustrialization, suggesting the engagement of the labour surplus in other sectors.

Table 4.2 *Categories of deindustrialization*

Decline Manufacturing Employment (-)	Employment Decreases (-)	Negative DZ (-)
Decline Manufacturing Employment (-)	Employment Increases (+)	Positive DZ (+)

4.3 Results

4.3.1 Types of deindustrialization

The following table (4.3) presents the fifteen countries included in the measurement. It illustrates the above indicators and combinations of the different types of deindustrialization. The table is divided into four time frames: 1971-1979, 1980-1989, 1990-1999, 2000-2009 and allocates the countries according to those who have shown positive, negative, mixed (positive and negative) and no deindustrialization. During the 1970s industrial decline was apparent in most countries except Ireland, Italy and Portugal. Negative manufacturing contraction occurred in Austria, Belgium, Finland, France, Greece, Spain and the United Kingdom. Throughout the remaining decades, most countries belong to the category of mixed deindustrialization, meaning that rises and falls occur within a decade.

Along with the table additional figures (Appendix A) present the trends for every country. The figures differentiate between positive and negative deindustrialization. Lines above zero indicate positive deindustrialization, whereas lines below zero negative. This typology indicates that during the 1980s, including the following decades, all countries have experienced some form of industrial contraction, whereas there is no definitive division between positive and negative. Although industrial contraction has been relatively constant, these initial mixed results could further suggest that overall economic fluctuations might influence the severity of this transition. The following results explore the absolute and percentage changes of manufacturing employment but they also illustrate in more detail changes in specific industries.

Table 4.3 *Types of deindustrialization*

Time Frame	Negative DZ (-)	Positive DZ (+)	Mixed DZ	No DZ
1971-1979	Austria Belgium Finland France Greece Spain UK		Denmark Norway Netherland Sweden Germany	Ireland Italy Portugal
1980-1989	Italy Ireland Sweden		Austria Belgium France Denmark Finland Germany Greece Netherlands Spain Norway Portugal UK	
1990-1999	Finland Greece	Italy	Austria Belgium Denmark France Germany Netherlands Spain Norway Ireland Portugal Sweden UK	
2000-2009			Austria Belgium Denmark France Greece Germany Finland UK Italy Ireland Portugal Netherlands Norway Sweden Spain	

Mixed DZ when a country undergone positive and negative DZ within a decade. No DZ when there was no drop in manufacturing employment for three consequtive years

4.3.2 The importance of manufacturing employment - absolute versus relative changes

This section focuses on the exploration of the absolute and relative importance of manufacturing employment starting from the 1970s. The reason behind this calculation is to show comparatively and in more detail the change in the progression of manufacturing employment on a decade basis. The choice of both absolute and relative changes is important since employment in manufacturing may demonstrate a reduction either on absolute or relative terms (or both). As it was mentioned in the introduction, this occurs because changes in manufacturing employment may surpass changes in other sectors of the economy. For instance, in some cases an absolute increase in manufacturing employment may be accompanied by a relative decrease if other sectors increase their employment faster.

Therefore, the tables (4.4-4.7) present the absolute and percentage (as a share of total employment) changes in the manufacturing employment for the years: 1971-1979, 1980-1989, 1990-1999 and 2000-2009. During the years 1971 to 1979, Belgium (-21%) showed the highest reduction in manufacturing employment followed by Norway (-20%), Netherlands (-19.70%) and Denmark (-16.60%). On the contrary Greece (32.12%), Italy (4.84%), Ireland (3.55%), Austria (0.25%) and Portugal (4.62%) increased the employment in manufacturing (Table 4.4).

During 1980s, the United Kingdom (-25.10%) had the highest decrease in employment followed by Norway (-24.74%), Netherlands (-22.54%) and Austria (-20.40%). There is no rise in the percentage change of manufacturing employment during this decade (Table 4.5). During the years 1990 to 1999, W.Germany (-25.30%) demonstrated the highest decline in percentage manufacturing employment followed by Greece (-24.42%), Netherlands (-22.41%) and Belgium (-21.12%). There is no rise in the percentage change of manufacturing employment during this decade. However, in absolute terms Spain, Norway and Ireland demonstrate a rise in manufacturing employment (Table 4.6).

Table 4.4 *Manufacturing employment 1971-1979*

Country	Year	ABS Change	% Change
Austria	1971-9	24,016	0.25
Belgium	1971-9	-241,901	-21.05
Denmark	1971-9	-78,141	-16.60
Finland	1971-9	22,367	-1.98
France	1971-9	-65,472	-5.67
W.Germany	1971-9	-980,000	-9.87
Greece	1971-9	186,038	32.12
Ireland	1971-9	27,269	3.55
Italy	1971-9	540,000	4.84
Netherlands	1971-9	-245,818	-19.70
Norway	1971-9	-6,600	-20.02
Portugal	1972-9	196,026	4.62
Spain	1971-9	-434,613	-9.83
Sweden	1971-9	-41,522	-11.30
UK	1971-9	-753,674	-12.92

Absolute and percentage changes in manufacturing employment 1971-1979

Table 4.5 *Manufacturing employment 1980-1989*

Country	Year	ABS Change	% Change
Austria	1980-9	-115,399	-20.40
Belgium	1980-9	-148,73	-16.50
Denmark	1980-9	-12,585	-7.68
Finland	1980-9	-67,200	-17.80
France	1980-9	-88,8200	-18.70
W.Germany	1980-9	-192,000	-0.49
Greece	1980-9	-48,487	-15.21
Ireland	1980-9	-24,413	-6.64
Italy	1980-9	-693,600	-13.40
Netherlands	1980-9	-68,614	-22.54
Norway	1980-9	-71,200	-24.74
Portugal	1980-9	-40,083	-13.12
Spain	1980-9	-243,941	-14.23
Sweden	1980-9	-58,293	-10.23
UK	1980-9	-1,365,000	-25.10

Absolute and percentage changes in manufacturing employment 1980-1989

During the years 2000 to 2009 (p.72), the United Kingdom (-36.25%) displays the highest decline in manufacturing employment followed by Ireland (-31.08%), Spain (-28.26%) and Portugal (-23.70%). There is no rise in manufacturing employment during this decade (Table 4.7). Table 4.8 (p.73) shows the maximum positive and negative values of deindustrialization. The United Kingdom and Spain demonstrated the maximum negative deindustrialization in 1980 and 2007, whereas the maximum positive deindustrialization occurred in Ireland and Belgium. The impor-

Table 4.6 *Manufacturing employment 1990-1999*

Country	Year	ABS Change	% Change
Austria	1990-9	-84,821	-18.80
Belgium	1990-9	-117,089	-21.12
Denmark	1990-9	-49,463	-11.04
Finland	1990-9	-53,100	-2.47
France	1990-9	-626,391	-18.11
W.Germany	1990-9	-561,000	-25.30
Greece	1990-9	-109,658	-24.42
Ireland	1990-9	67,513	-6.35
Italy	1990-9	-546,700	-6.62
Netherlands	1990-9	-65,581	-22.41
Norway	1990-9	15,600	-6.02
Portugal	1990-9	-54,398	-9.11
Spain	1990-9	164,918	-6.59
Sweden	1990-9	-143,072	-6.70
UK	1990-9	-799,500	-15.10

Absolute and percentage changes in manufacturing employment 1990-1999

tance of these tables lies on the fact that they display both the absolute and relative differences of contraction during those decades. Consequently, those results imply that although manufacturing employment might be reduced in relative terms, this does not occur always in absolute terms. This happens because the reduction of manufacturing, in relative terms, is influenced by the performance of other sectors. If other sectors of employment demonstrate better performance, this will affect the severity of employment reduction in manufacturing.

Table 4.7 *Manufacturing employment 2000-2009*

Country	Year	ABS Change	% Change
Austria	2000-9	-27,400	-11.65
Belgium	2000-9	-97,013	-21.01
Denmark	2000-9	-85,359	-20.05
Finland	2000-9	-67,900	-19.02
France	2000-9	-625,034	-21.09
W.Germany	2000-9	-669,000	-13.14
Greece	2000-9	13,946	-6.99
Ireland	2000-9	-6,1174	-31.08
Italy	2000-9	-210,800	-12.22
Netherlands	2000-9	-130,333	-20.05
Norway	2000-9	-19,500	-15.78
Portugal	2000-9	-242,168	-23.70
Spain	2000-9	-375,300	-28.26
Sweden	2000-9	-136,100	-23.46
UK	2000-9	-1,371,750	-36.25

Absolute and percentage changes in manufacturing employment 2000-2009

Table 4.8 *Maximum negative and positive deindustrialization 1971-2009*

Country	Year	Max DZ -	Year	Max DZ +
Austria	1981	-2.96	1984	0.78
Belgium	1975	-6.32	1998	5.92
Denmark	1973	-4.91	2004	1.84
Finland	1990	-8.53	1988	1.66
France	1992	-3.00	1998	1.78
Germany	1991	-5.83	2005	1.39
Greece	1981	-6.66	2006	0.85
Ireland	2007	-8.09	1998	9.45
Italy	1982	-2.23	1999	1.91
Netherlands	1980	-7.29	1996	2.77
Norway	1988	-3.59	2006	1.08
Portugal	2007	-2.51	1998	3.75
Spain	2007	-15.25	1999	5.60
Sweden	1991	-9.24	1999	1.94
UK	1980	-10.14	1988	4.25
W. Germany 1971-1990	1981	-2.71	1988	0.56
Av. Negative/Positive		-6.20		2.85

4.3.3 The importance of the components of manufacturing and mining

This section includes the detailed changes occurring in every industry together with mining. This happens for two reasons. The first objective is to show that the decline in employment did not uniformly occur in every industry with some industries being more important or successful than others. The second objective is to demonstrate that these variations were not confined to a single country but occurred across countries and decades. This way it can be observed in more detail how the same industry progressed through time and across different locations.

The following table (4.9) presents the absolute and percentage change in mining employment. The most severe reduction in percentage terms occurred in Belgium (-91.71%) followed by France (-85.16%) and the United Kingdom (-84.67%). This is not surprising since the mining sector has been important in those countries. On the contrary Norway (80%) showed an increase. The following tables (4.10 to 4.13) display the industries that belong to the manufacturing sector during the years 1980 to 2009. The decline in employment in the furniture and recycling industry was more severe in Belgium (-57.91%) and Austria (-48.79%).

Table 4.9 *Mining employment 1980-2009*

Country	Year	ABS Change	%Change
Austria	1980-2009	-10,779	-71.93
Belgium	1980-2009	-27,029	-91.71
Denmark	1980-2009	-640	-20.00
Finland	1980-2009	-2,800	-34.15
France	1980-2009	-1,135,000	-85.16
W.Germany	1980-2009	-166,000	-76.34
Greece	1980-2009	-6,704	-48.15
Ireland	1980-2009	-3,782	-61.22
Italy	1980-2009	-24,000	-45.16
Netherlands	1980-2009	-1,997	-54.50
Norway	1980-2009	26,800	80.00
Portugal	1980-2009	-5,400	-41.38
Spain	1980-2009	-39,724	-70.31
Sweden	1980-2009	-7,970	-52.63
UK	1980-2009	-313,215	-84.67

Absolute and percentage changes in mining employment 1980-2009

Table 4.10 *Components manufacturing 1980-2009*

Country	Year	ABS Change. Furn.- Recy.	% Change Furn.- Recy.
Austria	1980-2009	-20,759	-48.79
Belgium	1980-2009	-24,041	-57.91
Denmark	1980-2009	-12,652	-45.15
Finland	1980-2009	-11,300	-45.43
France	1980-2007	-10,176	-48.64
W.Germany	1980-2007	-65,000	-42.3
Greece	1981-2009	-8,752	-35.24
Ireland	1980-2009	1,684	-32.69
Italy	1980-2009	-9,800	-13.55
Netherlands	1980-2009	27,158	-30.12
Norway	1980-2009	-4,800	-47.52
Portugal	1980-2006	7,909	-12.75
Spain	1980-2009	-43,338	-48.33
Sweden	1980-2009	-26,416	-44.06
UK	1980-2008	-60,183	-34.80

Absolute and percentage changes in furniture and recycling employment 1980-2009

As far as the food and tobacco industry is concerned, Ireland (-58.54%), Netherlands (-57.38%) and the UK (-47.69%) showed the highest decline. The reduction in employment of the textile industry was more obvious in Ireland (-91.68%) and the UK (-87.20%) (Table 4.11). The highest reduction of employment in wood industry occurred in Norway (-60.90%), Greece (-60.86%) and Finland (-59.17%). The employment in the paper industry was reduced in Netherlands (-58.10%), Nor-

way (-51.32%), Sweden (-47.42%) and Finland (-47.36%) (Table 4.12). The wood industry held an important position in Scandinavia and especially in Finland, where the wood industry had been a significant employer (Pike, 2009).

Table 4.11 *Components manufacturing 1980-2009*

Country	Year	ABS Change Food Tobacco	% Change Food Tobacco	ABS Change Textiles	% Change Textiles
Austria	1980-2009	-32,968	-46.59	-88,794	-83.66
Belgium	1980-2009	-19,842	-31.73	-93,850	-78.44
Denmark	1980-2009	-35,526	-42.28	-31,584	-82.66
Finland	1980-2009	-28,700	-47.14	-65,900	-85.93
France	1980-2007	-9,264	-19.01	-539,962	-81.89
W.Germany	1980-2007	56,000	-25.30	-589,000	-83.12
Greece	1980-2009	16,802	-9.67	-122,489	-71.07
Ireland	1980-2009	-18,967	-58.54	-36,093	-91.68
Italy	1980-2009	7,300	-9.36	-713,000	-56.15
Netherlands	1980-2009	-47,675	-57.38	-45,615	-81.79
Norway	1980-2009	-10,400	-37.89	-17,300	-84.19
Portugal	1980-2006	-18,864	-33.62	-138,593	-48.85
Spain	1980-2009	27,561	-32.94	-343,914	-78.84
Sweden	1980-2009	-31,476	-39.52	-31,569	-77.85
UK	1980-2008	-272,643	-47.69	-690,240	-87.20

Absolute and percentage changes in food tabacco and textiles employment 1980-2009

Table 4.12 *Components manufacturing 1980-2009*

Country	Year	ABS Change Wood	% Change Wood	ABS Change Paper	% Change Paper
Austria	1980-2009	-2,693	-29.62	-19,438	-47.14
Belgium	1980-2009	-240	-18.80	-17,137	-40.78
Denmark	1980-2009	-2,347	-25.38	-24,726	-47.28
Finland	1980-2009	-31,700	-59.17	-42,900	-47.36
France	1980-2007	-57,693	-51.29	-83,109	-37.55
W.Germany	1980-2007	-54,000	-47.57	-65,000	-36.51
Greece	1980-2009	-20,280	-60.86	7,680	-6.04
Ireland	1980-2009	3,211	-1.88	-389	-42.16
Italy	1980-2009	-111,900	-47.61	-44,800	-24.16
Netherlands	1980-2009	-2,540	-48.60	-39,184	-58.10
Norway	1980-2009	-14,000	-60.90	-17,500	-51.32
Portugal	1980-2006	-24,327	-46.12	3,840	-17.12
Spain	1980-2009	-20,285	-49.66	86,416	0
Sweden	1980-2009	-21,990	-42.24	-61,239	-47.42
UK	1980-2008	-29,687	-36.74	-153,270	-38.46

Absolute and percentage changes in wood and textiles employment 1980-2009

The industry of chemical products increased its employment in Ireland (7.23%) and Denmark (12.03%). On the contrary the UK (-50.18%) and Netherlands (-50.41%) declined their employment in this industry. The employment in the non-metallic mineral products industry was reduced mostly in the UK (-65.64%), Netherlands (-58.55%) and Ireland (-57.88%) (4.13). Finally, the highest reduction in employment of metals, machinery and equipment industry occurred in the UK (-67.05% and -63.47%), Netherlands (-54.18% and -55.06%) and Belgium (-50.66% and -53.21%) (Table 4.14, p.78).

Table 4.13 *Components manufacturing 1980-2009*

Country	Year	ABS Change Chemicals	% Change Chemicals	ABS Change Minerals	% Change Minerals
Austria	1980-2009	-13,733	-38.59	-9,406	-40.49
Belgium	1980-2009	-9,477	-24.49	-24,086	-54.86
Denmark	1980-2009	9,020	12.03	-15,246	-56.17
Finland	1980-2009	-8,000	-23.60	-7,200	-36.01
France	1980-2007	-150,565	-41.49	-124,755	-54.54
W.Germany	1980-2007	-62,000	-34.46	-94,000	-48.91
Greece	1980-2009	2,111	-18.25	-10,259	-41.64
Ireland	1980-2009	15,341	7.23	-4,741	-57.88
Italy	1980-2009	-91,900	-26.91	-79,800	-32.92
Netherlands	1980-2009	-17,044	-50.41	-11,575	-58.55
Norway	1980-2009	-7,303	-44.33	-3,606	-43.47
Portugal	1980-2006	-15,771	-41.57	-9,771	-31.74
Spain	1980-2009	26,664	-30.56	-38,354	-48.96
Sweden	1980-2009	-25,124	-35.08	-16,240	-52.58
UK	1980-2008	-288,778	-50.18	-163,315	-65.64

Absolute and percentage changes in chemicals and non-metallic minerals1980-2009

4.3.4 The progression of deindustrialization and recession

Although the previous tables have presented the changes in industrial employment on a decade basis, nevertheless they do not provide any information regarding the progression of the severity of industrial contraction. This section shows the annual progression of industrial employment accompanied by unemployment rises and falls. This is essential since it has been hypothesized that deindustrialization is influenced by recession periods, where overall unemployment rises. In the same context, the previous tables have already shown that the reduction in industrial employment differs across time and space. Therefore, it would be useful to annually display those variations in every country.

Table 4.14 *Components manufacturing 1980-2009*

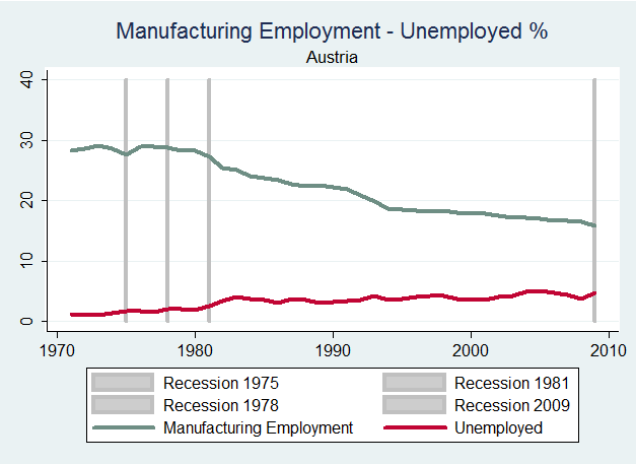
Country	Year	ABS Change Metals	% Change Metals	ABS Change Machinery	% Change Machinery
Austria	1980-2009	-32,745	-41.77	-2,926	-25.47
Belgium	1980-2009	-67,160	-50.66	-99,063	-53.21
Denmark	1980-2009	-9,475	-24.23	-31,359	-28.76
Finland	1980-2009	6,800	6.58	-1,000	-5.94
France	1980-2007	-307,805	-47.59	-547,128	-47.32
W.Germany	1980-2007	-69,000	-33.70	-73,000	-31.17
Greece	1980-2009	-3,104	-26.04	-27,171	-45.17
Ireland	1980-2009	-758	-43.24	35,030	8.79
Italy	1980-2009	-83,000	-18.55	-290,500	-26.41
Netherlands	1980-2009	-30,511	-54.18	-64,676	-55.06
Norway	1980-2009	-12,323	-45.04	-5,468	-28.50
Portugal	1980-2006	-6,270	-27.47	-23,314	-35.25
Spain	1980-2009	6,587	-36.36	44,388	-32.68
Sweden	1980-2009	-65,070	-41.90	-80,159	-28.21
UK	1980-2008	-665,826	-67.05	-1,255,559	-63.47

Absolute and percentage changes in basic metals and machinery equipment1980-2009

The subsequent figure (4.1) displays the annual manufacturing employment (%) in every country and annual unemployment (%). Unemployment has been calculated as the difference between the civilian labour force and civilian employment annually and for every country. The shaded lines present the recessionary periods in order to identify the time points when unemployment occurred (more figures are displayed on the Appendix B). Manufacturing decline has been constant in general terms, whereas short rises did not manage to bring manufacturing to its initial stage of the early 1970s.

Manufacturing employment in Austria rose slightly during the 1970s, whereas unemployment fluctuated throughout the 40 year time period. Unemployment in Belgium reached a peak in the early 1980s and 1990s during recession, while the reduction in manufacturing employment remained relatively constant. Similarly, unemployment in Denmark grew during recession periods (1980s and 1990s), whereas the decrease in manufacturing employment remained stable. In Finland the recession of the early 1990s resulted in an extensive fall in employment. Unemployment in France increased during the mid-1980s and went even higher during the 1990s. On the contrary unemployment in Germany fluctuated during recession periods. Reduction in manufacturing employment in France was constant, whereas in Germany there was a short rise during the 1980s

Figure 4.1 *Austria employed and unemployed*



Source Own calculations - OECD- Labour Force and STAN Databases

Growth in manufacturing employment in Greece occurred during the 1970s, however unemployment accelerated during the 1980s recession and after a short reduction continued to rise until recently. The recession of the 1980s led to an increase in unemployment and manufacturing employment decreased predominantly during the 2000s. Mid-1990s and 2000s display elevated unemployment in Italy and mid-1980s in the Netherlands and Ireland. In the late 1980s, manufacturing employment in Italy and the Netherlands briefly rose but continued to decline.

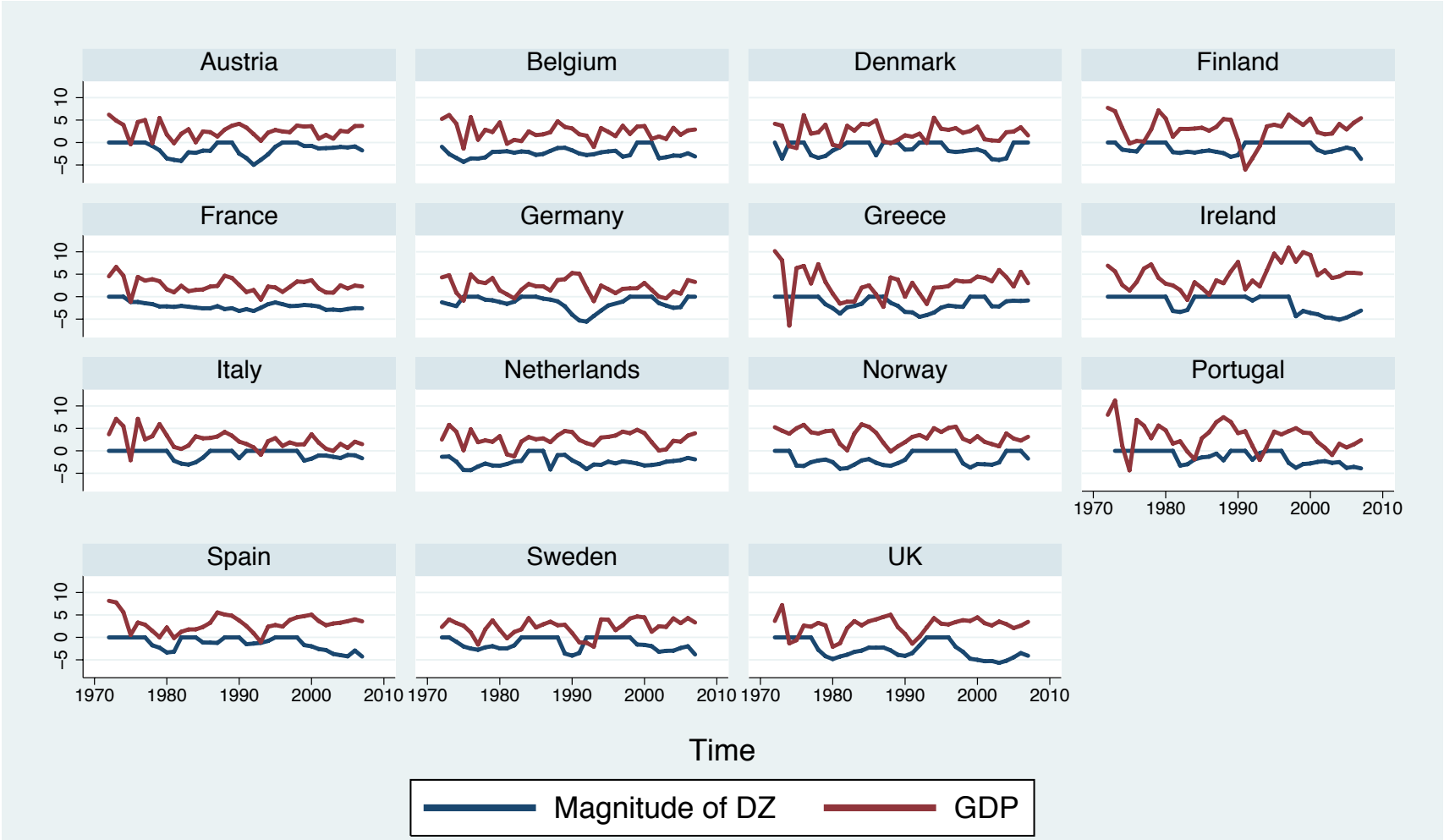
Manufacturing employment in Norway and Portugal has been declining since the 1970s with an exception of a short rise during the 1990s. Unemployment rose for a short period during the 1980s, 1990s and 2000s. The recession of the 1990s led to an elevated unemployment and a noticeable decrease in manufacturing employment in Sweden. After the 1980s manufacturing employment in Spain displays a constant decrease, while unemployment reached a peak during the mid-1980s and 1990s. Finally, the contraction of manufacturing employment in the UK remained relatively stable since the 1970s with a small increase during the 1990s. The recession of the 1980s in particular led to an extended growth of unemployment.

These graphs indicate that the relatively constant reduction in employment is a common element across countries, whereas recession periods contribute to the rise of unemployment. Nevertheless, the magnitude of industrial decline and rises in unemployment progress unevenly across places. The distinctive nature of industrial contraction across countries could be due to the different causes of occurrence.

Those causes are concentrated on internal factors, such as political decisions and changes in patterns of consumptions towards service-based goods. In parallel to this, specialization, through technological innovations, promotes less labour intensive industries and consequently this series of events has accelerated this process in some countries. Finally, the globalization of the markets shifted the industrial productivity towards countries that offered cheaper labour (Nordhaus, 2005; Pitelis and Antonakis, 2003; Alderson, 1999).

The final figure (4.2., p.80) of this chapter displays the progression of industrial decline and overall economy. The GDP is used as a proxy of economic growth and contraction, whereas the indicator *Magnitude* presents only periods of industrial decline. In most European countries more severe industrial decline coincides with periods of overall economic downturns. This supports further the hypothesis that although industrial decline has occurred independently to recessions, however more severe industrial decline appears together with economic contractions. This is not surprising since the manufacturing sector has been the main employer for many countries during the 1970s, therefore it has been affected by overall economic shocks and upturns.

Figure 4.2 *Progression of industrial decline and economy*



Magnitude of DZ and GDP in percentages. Source Own calculations - UN and STAN Databases

4.4 Conclusions

This results chapter has explored the pace and timing of deindustrialization across Europe and answered the question of whether it is possible to detect common patterns of this event. The contribution of this chapter is methodological and this is accomplished in two ways. Due to the comparative nature of this chapter, a single measurement and typology of industrial contraction has been calculated in order to assess the severity of industrial decline across different European countries. The severity of industrial contraction has been perceived as a sustained decline for three years for two reasons. First, deindustrialization is a transition from industries to services, therefore it has been continuous but also uneven across countries. Second, this way the magnitude of industrial contraction is distinguished from recession periods since it lasts for longer time periods.

Results have shown that every country has undergone a process of deindustrialization starting from the late 1970s. However, there is not any clear distinction between positive and negative deindustrialization, since most countries experienced a mixed type of deindustrialization, positive and negative. Throughout the 1980s every country had already reduced the employment in the manufacturing sector. The United Kingdom, Spain, Ireland and Belgium are the countries that have demonstrated the most severe industrial contraction (positive or negative). Trends reveal that, for most countries, deindustrialization has been continuous and brief escalations did not bring manufacturing employment to its original importance as a country's main employer.

This chapter is important since it has revealed that industrial contraction is a complex transition that is uniquely and unevenly shaped at a country level. More precisely, it occurs independently of recessions and its magnitude increases during periods of economic contractions since it constitutes part of the economy. Deindustrialization is a combination of many elements and it is quite challenging to measure all its aspects simultaneously.

This chapter has followed a labour market perspective and considered deindustrialization as a combination of declining manufacturing employment and rising or falling unemployment that distinguishes between positive and negative deindustrialization. The decline in employment in this sector has existed separately from recessions, however elevated unemployment that leads to negative deindustrializa-

tion has been influenced by the downturn of business cycles. Although these events have occurred in many countries worldwide, nevertheless the timing and the extent vary among and within countries and population groups.

The uneven progression, in terms of timing and magnitude, of industrial contraction across countries has occurred for various reasons. First of all deindustrialization is driven by political and economic factors operating at national and international levels. At a national level, political decisions implementing different market policies have accelerated the transition towards services in some countries such as the United Kingdom. Furthermore, the changing patterns of consumption towards more service-based goods have contributed to this transition. At an international level, global industrial competition, technological innovations, creating less labour intensive industries, and import of manufactured goods from less developed countries are the main causes of uneven industrial decline (Pike, 2009; Nordhaus, 2005; Pitelis and Antonakis, 2003).

In conclusion, this chapter has demonstrated that deindustrialization is a complex economic transition. In particular its timing of occurrence and magnitude are progressed differently across countries. Every country has its own unique industrial history with some industries being more important than others. More precisely, the decline of the mining sector in the United Kingdom has resulted in post-industrial coalfield areas, whereas the ship-building and wood industries had the greatest importance in Scandinavia.

Nevertheless, there are some common elements across space. First, that industrial decline has been relatively constant and second it is shaped by overall economic performances and recession periods. Thirdly, the speed of this transition has been formulated by a combination of factors such as political decisions as well as global and domestic competitions.

The subsequent chapter progresses in the same context by statistically examining whether there is an association between industrial decline and mortality. It extends the analysis provided in the initial stage of this thesis. Using the same data, the next chapter evaluates the nature of this relationship by taking into account the elements of timing and magnitude. This occurs by differentiating between the long and short-term effects as well as normal and severe fluctuations of industrial and economic decline on mortality.

Chapter 5

The association - deindustrialization, recession and mortality

5.1 Introduction

The previous chapter revealed that the industrial contraction has progressed unevenly across countries. The magnitude of its occurrence demonstrates different patterns across space, whereas the severity of this event is influenced by recession periods. The industrial sector has been the main source of employment for many European countries. Therefore it can be hypothesized that employment fluctuations in the industrial sector, during economic expansions and contractions, can be connected with mortality variations. This chapter extends the findings of the previous chapter by exploring the nature of the association between deindustrialization and mortality.

At an aggregated level, literature has found that cyclical upturns can positively influence health, whereas economic downturns (unemployment increases), can have negative health implications on the population (Brenner, 1971, 1975, 2005; Bunn, 1979). However, recent research conducted by Gerdtham and Ruhm (2006) and many other scholars (Ruhm, 2005; Svensson, 2007; Stuckler et al., 2009a; Neumayer, 2004) provided opposing and mixed results compared to the previous approaches. Economic expansions can be responsible for short-term elevated mortality revealing a procyclical relationship for certain causes of death such as cardiovascular and liver disease, influenza and pneumonia. In this case, a procyclical

relationship exists when there is a positive association between business fluctuations and mortality. More precisely, when the overall economy strengthens and this is associated with rises in mortality and vice versa.

In contrast, suicides and homicides demonstrate a countercyclical behaviour. A countercyclical relationship refers to a negative relationship between economy and mortality. For example, when economy weakens and this is related to a rise in certain causes of death (Ruhm, 2000; Neumayer, 2004; Gerdtham and Johannesson, 2005). On the other hand, during economic expansions, atmospheric pollution and traffic accidents are positively associated with cardiovascular incidents and respiratory-related deaths. Thus, additional intervening processes, occurring during economic upturns, such as job-related anxiety, adverse health behaviour (smoking and alcohol consumption) and dietary habits can accelerate some of these variations (Ruhm, 2005; Granados, 2008).

The main interest of this chapter is to examine the impact of deindustrialization and recession on the formulation of mortality patterns across different European countries. Deindustrialization has progressed independently to the overall economic contractions, as the nature of industrial decline has been relatively constant compared to recessions. Nevertheless, the industrial sector constitutes a component of a country's economy, thus it is shaped by a country's economic expansion or contraction. Subsequently, it can be hypothesized that certain causes of death could be minimized, whereas others could be accelerated.

In order to test this hypothesis this chapter includes all-cause and suicide mortality in the analysis. The inclusion of suicides is based on results of previous research indicating that recessions, via the route of unemployment, are associated with a rapid acceleration of suicide rates (Stuckler et al., 2009a). Furthermore, the inclusion of all-cause mortality contains the most common causes of death, whereas suicides, as a less common cause of mortality, are expected to progress differently.

This chapter aims to further explore the elements of time and magnitude introduced in the previous chapter. It extends the main objective of whether industrial contraction is associated with mortality by exploring the long and short-run associations of different economic indicators, describing deindustrialization, recession and overall wealth. Furthermore, in terms of magnitude, it statistically examines the mortality variations of more severe periods of industrial contraction and recession.

Therefore the following questions are asked:

- What is the relative importance of national wealth, recession and industrial contraction on mortality trends?
- Is it possible to identify the short and long-term patterns of association between deindustrialization and mortality?

5.2 Methods

5.2.1 Data and sample

Due to the comparative nature of the research questions, this chapter uses the same information introduced in chapter 4. In more detail, it includes mortality data from the World Health Organization (WHO), whereas economic data is obtained from international databases such as the Organization of Economic Development and Cooperation (OECD), the Structural Analysis Database (STAN) and the United Nations National Accounts Main Aggregates Database.

Dependent variables-mortality

Since the interest lies in examining the contribution of deindustrialization and recession on different causes of death, mortality data has been obtained from the World Health Organization and covers a forty year period (1971-2009). The WHO Mortality database (November 2011 update) contains deaths catalogued in registration systems of every country and coded in accordance with the International Classification of Diseases (ICD). The underlying cause of death is defined as *"the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury"* (WHO, 2013). The direct method of standardization has been implemented for the calculation of the all-cause and suicide rates by using the European Standard Population. Age Standardized Mortality Rates (SMR) are calculated for the causes mentioned above covering the working age male and female population aged 20-59. The choice of this age range is based on the fact that the interest is concentrated on the trends

of unemployment and manufacturing employment, therefore the choice of mortality refers also to the working age population.

Suicide mortality-International classification of diseases (ICD 8th-9th-10th)

For the needs of the current analysis mortality, due to suicides, covers not only the deaths defined as suicides but also mortality classified as undetermined events. In the special case of suicide, the coroner could conclude that the cause of death was stated as suicide/self-inflicted injury or, due to insufficient evidence, defined as injury undetermined whether accidentally or purposely inflicted (open-verdict) (Brock and Griffiths, 2003). However, because of the variations among and within countries, concerning the determination of suicide from the appropriate civil bodies (coroners), the inclusion of undetermined events could provide an additional and more consistent evaluation of deaths that are possibly suicides (Barr et al., 2012; Hawton et al., 2011).

Since the precision of detecting causes of mortality can differ across countries, the implementation of the International Statistical Classification of Diseases (ICD) provides a consistent way to tackle any comparability issues. Although the ICD and its revisions provide a relatively uniform approach of recoding mortality, still caution is necessary when interpreting mortality data across countries and time. Most comparability issues are concentrated on the heterogeneity of the various ICD revisions and the applicable civil authorities regarding the sufficiency of death information (Bhalla et al., 2011).

In more detail, the most recent ICD coding, ICD-10, provides more exhaustive knowledge based on a combined form of characters and numbers of causes of death compared to previous revisions (ICD-9 has 6,969 codes compared to ICD-10 which has 12,420 codes). The codes between the 9th and 10th revision of ICD vary mainly at the level of detail (third and fourth level). Various adaptations exist also between the 8th and 9th revisions of ICD. Changes in the 9th revision are mainly concentrated on reallocations and rearrangements of diseases to different chapters or the inclusion of new sections. For instance, additional information is provided describing not only the underlying cause of death but also the human organ affected through the inclusion of four and five digit subdivisions (WHO, 2010).

In addition, coding concerning late effects of these causes are merged in one code in the 10th revision (Y87) and not assigned in the related chapters of suicide and undetermined event as in the 9th revision (Griffiths and Rooney, 2003). However, due to small number of deaths concerning late effects, these are excluded from the analysis. Since the current chapter includes the time span from 1971 to 2009 mortality data is derived from the following ICD revisions.

Table 5.1 *Suicides and undetermined injuries - ICD revisions*

Cause of death	**ICD 8**	**ICD 9**	**ICD 10**
Suicides/Self-inflicted injury	E950-E959	E950-E959	X60-X84
Undetermined Injury	E980-E989	E980-E989	Y10-Y34

Independent variables - economic indicators

Economic data is originated by the United Nations National Accounts Main Aggregates Database which is a large international repository. Data is requested from national statistics offices and official publications together with the appropriate documentation concerning the collection of the data. Once the appropriate inspection (i.e consistency, error checking) concerning the quality of the data occurs, then information is incorporated into the database. After the data is obtained at national currency then the prices are converted to US dollars through the implementation of suitable exchange rates (UN, 2013).

The Gross Domestic Product (GDP) and in particular the GDP per capita in US dollars is a commonly used indicator describing the national economic performance (Stuckler et al., 2008; Chung and Muntaner, 2007; Granados, 2005). In more detail, GDP per capita is defined as the GDP per head and is calculated as the aggregate of production (GDP) divided by the population size (UN, 2013). It describes not only the national economic performance but also the average economic welfare of the population. The cyclical variations of GDP per capita are more representative of the changes in personal income compared to the GDP growth. Nevertheless, GDP per capita is limited to the average standard of living; therefore internal prosperity variations and inequalities are not taken into account (OECD, 2013).

Independent variables - manufacturing employment and unemployment

The above economic measures express the overall economic performance. However, when it comes to the relationship between economic fluctuations and mortality other measures could enhance the sufficiency of the analysis. Previous research, examining this relationship, found that there is a closer association between variations in employment and temporary changes in health contrary to indicators measuring a country's overall performance. Although short-term downturns in GDP are usually followed by rises in unemployment nevertheless the strength of this impact varies over time and across countries (Stuckler et al., 2009a).

Therefore the next set of indicators depicts the overall and sectoral labour market. Manufacturing employment data is obtained by the Structural Analysis Database (STAN). The STAN database is a wide-ranging tool for exploring various aspects of industrial performance (STAN, 2012). Unemployment data is derived from the Labour Force Database of the OECD for the years 1971 until 2009 (OECD, 2011b).

For the analysis the civilian unemployment, excluding the armed forces, is included. Civilian unemployment includes those without work, seeking work, those currently available for work and those temporarily absent from their jobs with no formal job attachment. Furthermore, students, homemakers, those engaged in non-economic activities and those who satisfy the above criteria are also regarded as unemployed. The above criteria are defined in accordance with the ILO recommendations (OECD, 2011a). Overall civilian unemployment is divided by gender. Employment in manufacturing could not be separated in terms of gender due to lack of adequate data availability.

5.3 An exploration of mortality variations

Since the main objective is to identify whether there is an association between deindustrialization and mortality, this section begins by exploring the mortality variations of the countries included in the index. This takes place in two steps. The first step calculates the overall change (1971 and 2009) of all-cause and suicide mortality, whereas the second step illustrates the performance of each country on a decade basis. More precisely, the following table (5.2) illustrates the overall change

(1971-2009) of all-cause mortality and suicides for males and females and for every country.

The highest reduction in all-cause male mortality occurred in Finland (-56.61%) followed by Italy (-56.22%) and Austria (-54.40%). The least reduction took place in Greece (-19.24%). Italy (-55.46%) showed the highest reduction in all-cause female mortality followed by Spain (-55.05%) and Austria (-54.45%). The highest reduction in suicide male mortality occurred in Denmark (-60.64%), whereas Ireland (64.96%) and Spain (61.33%) demonstrated an increase in male suicides. Female suicide mortality increased only in Belgium, Norway and Spain with the highest decrease appearing also in Denmark.

Table 5.2 *All-cause and suicides 1971-2009*

Country	Year	All Cause Males	All Cause Females	Suicides Males	Suicides Females
Austria	1971-2009	-54.40	-54.45	-43.91	-62.60
Belgium	1971-2005	-43.04	-41.54	41.67	2.02
Denmark	1971-2006	-29.75	-36.74	-60.64	-78.80
Finland	1971-2009	-56.61	-44.11	-30.56	-2.32
France	1971-2008	-43.64	-44.52	-2.71	-11.50
Germany	1971-2009	-50.37	-51.73	-52.79	-71.54
Greece	1971-2009	-19.24	-44.11	-10.34	-51.19
Ireland	1971-2009	-48.09	-53.30	64.96	-15.34
Italy	1971-2008	-56.22	-55.46	2.35	-34.25
Netherlands	1971-2009	-52.73	-34.16	21.93	-19.11
Norway	1971-2009	-48.52	-35.35	15.88	39.53
Portugal	1971-2009	-46.63	-54.33	-26.81	-17.67
Spain	1971-2008	-43.95	-55.05	61.33	46.72
Sweden	1971-2009	-49.81	-44.78	-55.65	-56.56
UK	1971-2009	-48.57	-46.46	3.93	-60.77

All-cause and suicide male and female mortality percentage change

5.4 Towards a relationship

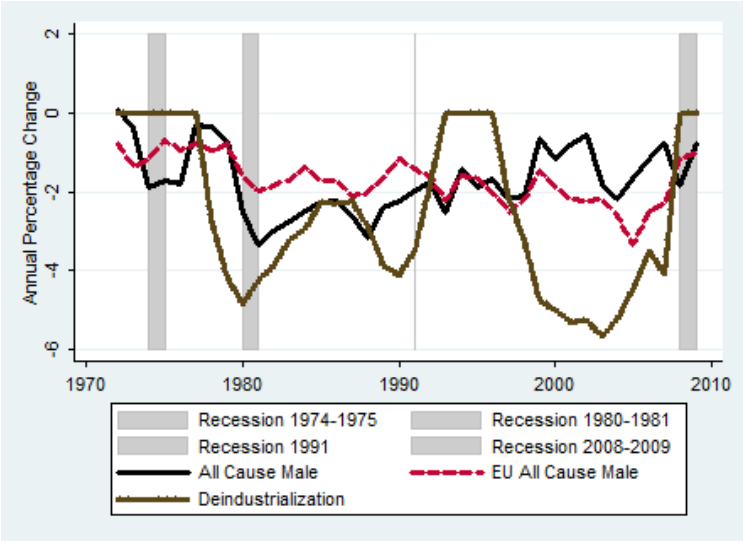
Moving closer towards the objective of this chapter this section combines the elements of deindustrialization, recession and mortality. The subsequent line figures present the trends of a selection of countries that demonstrated above the average negative deindustrialization. This type of deindustrialization is the most severe one, since it describes the inability of a country to absorb the labour force derived from manufacturing. The countries are: Finland, Sweden, Spain and the United Kingdom.

Regarding mortality, standardized mortality rates of these countries are displayed in contrast to European average, as an annual change in three year moving averages. The mortality rates present both genders of the population (figures of the remaining countries are in the Appendix C, D, E). The standardized mortality rates are confined to all-cause mortality and deaths due to suicides. The mortality rates present females and males of the working age population (20-59) separately.

In parallel to this, the vertical lines illustrate the recessionary periods together with the magnitude of industrial decline (purple line). The magnitude shows only the periods and the extent of the reduction in manufacturing employment. It is the same indicator used in the calculation of the index that isolates periods of industrial decline for three consecutive years.

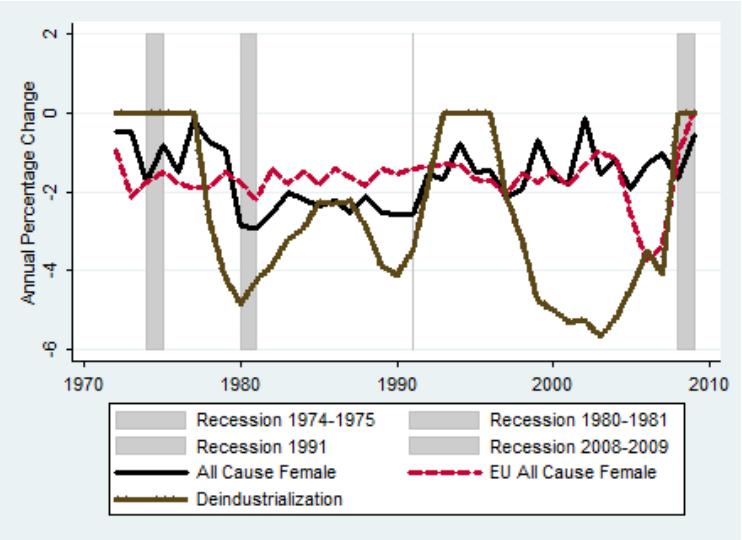
Looking at the following figures, in the case of the United Kingdom male and female all-cause mortality reveals similar trends for both genders. Reduction in overall mortality appears to accelerate during the 1980s and slow-down in the early 2000s above the European average. Industrial decline fluctuates across the entire period but increases its pace during periods of economic slowdown (1980s and 1990s). Related to suicides short increases occur during the 1980s and 1990s (industrial decline and recession) especially for males (5.1-5.4).

Figure 5.1 *All-cause male UK*



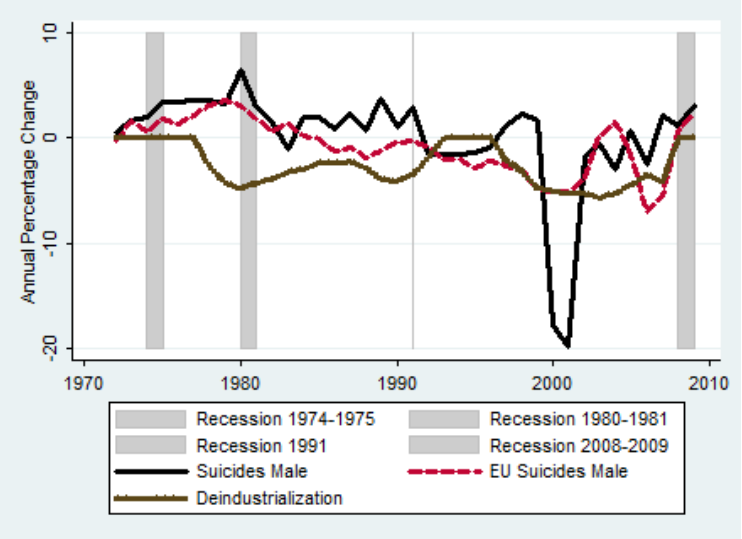
Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure 5.2 *All-cause female UK*



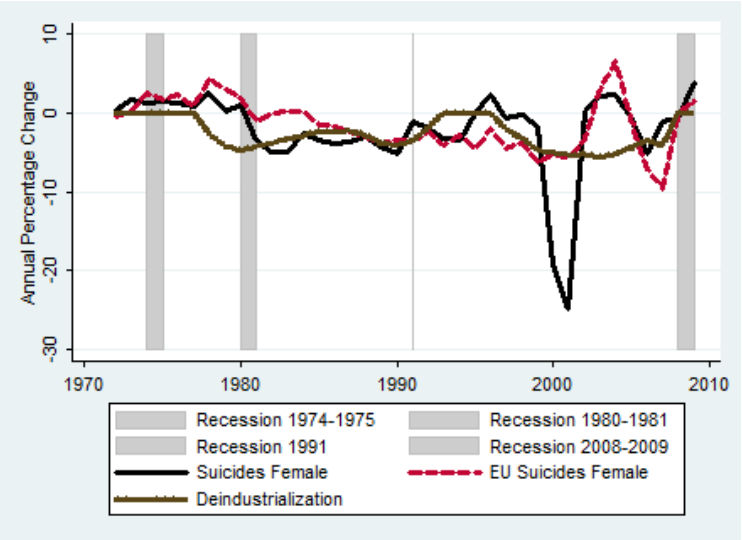
Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure 5.3 *Suicides male UK*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

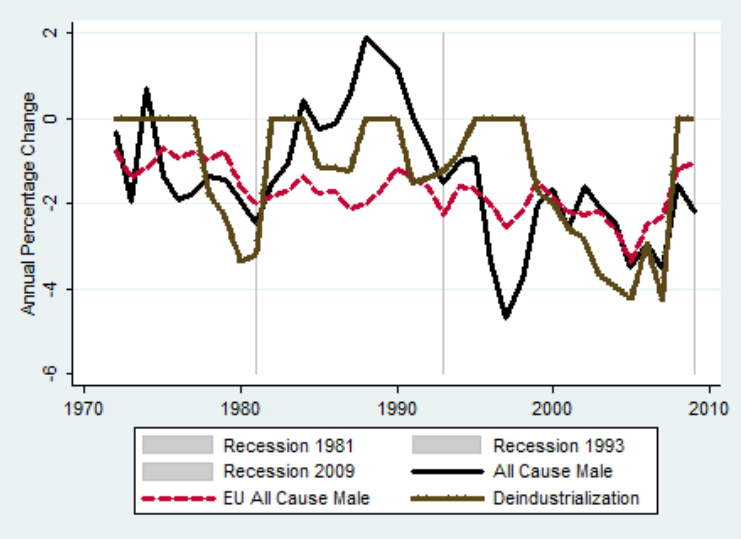
Figure 5.4 *Suicides female UK*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

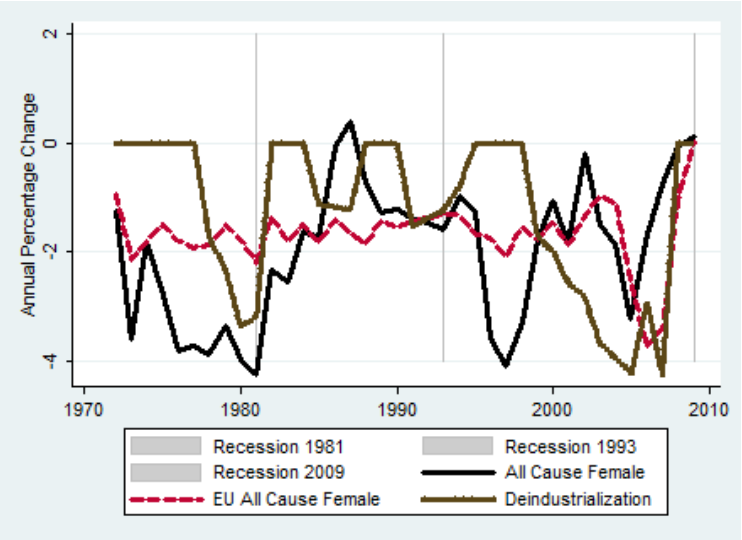
In Spain a deceleration in decrease accompanied by a brief increase in all-cause mortality occurs within the recessionary periods of 1980s and 1990s (5.5-5.6).

Figure 5.5 *All-cause male Spain*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

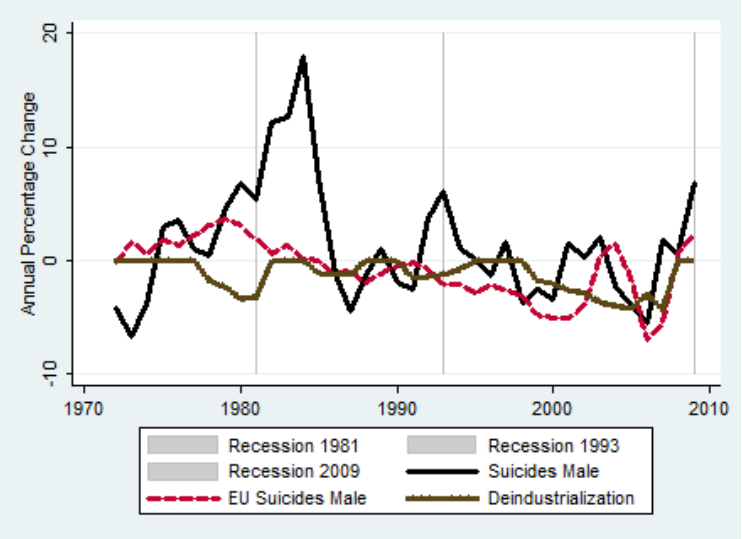
Figure 5.6 *All-cause female Spain*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

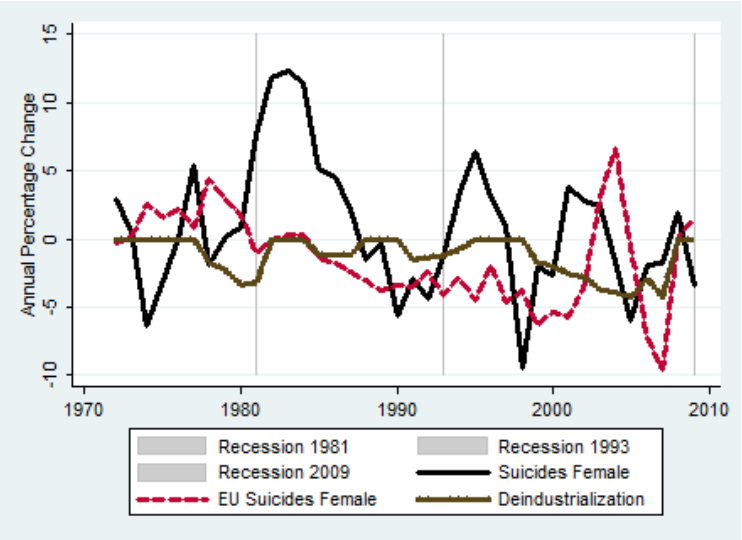
For suicides similar trends are observed for both genders, where suicides mainly accelerate during periods of economic downturn (5.7-5.8).

Figure 5.7 *Suicides male Spain*



Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

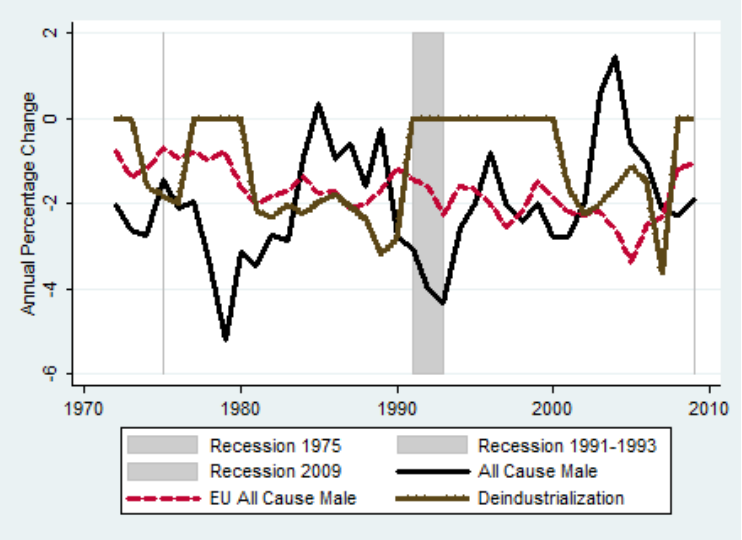
Figure 5.8 *Suicides female Spain*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

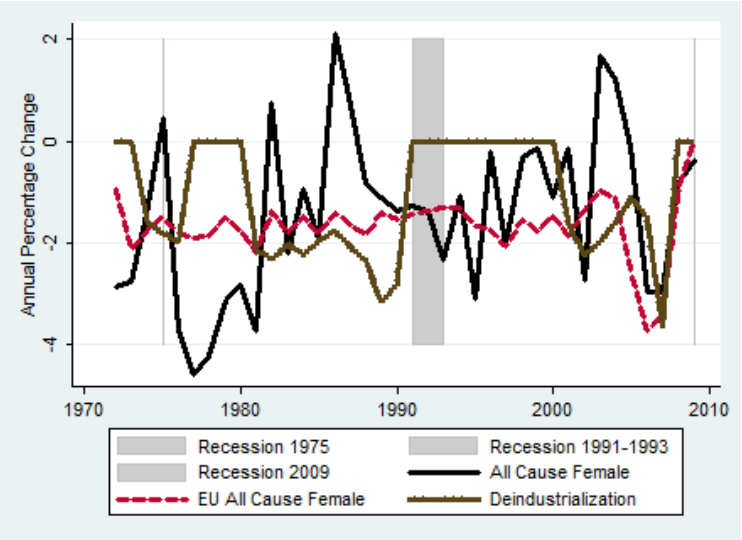
In the case of Finland (5.9-5.12) and Sweden (5.13-5.16) overall male mortality has declined since the 1970s, however the decline seems to move at a slower pace and beyond the European average during the 1980s and 2000s. For Finnish females mortality demonstrates a slight increase during the mid-1980s as well as mid-2000s.

Figure 5.9 *All-cause male Finland*



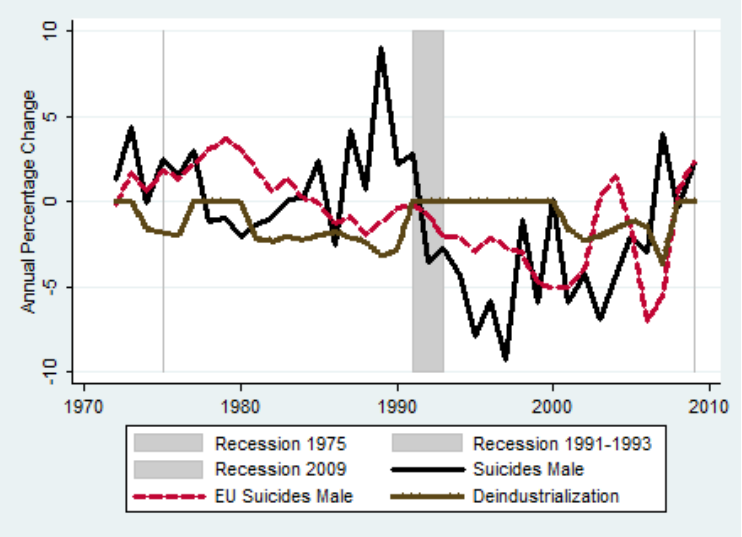
Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure 5.10 *All-cause female Finland*



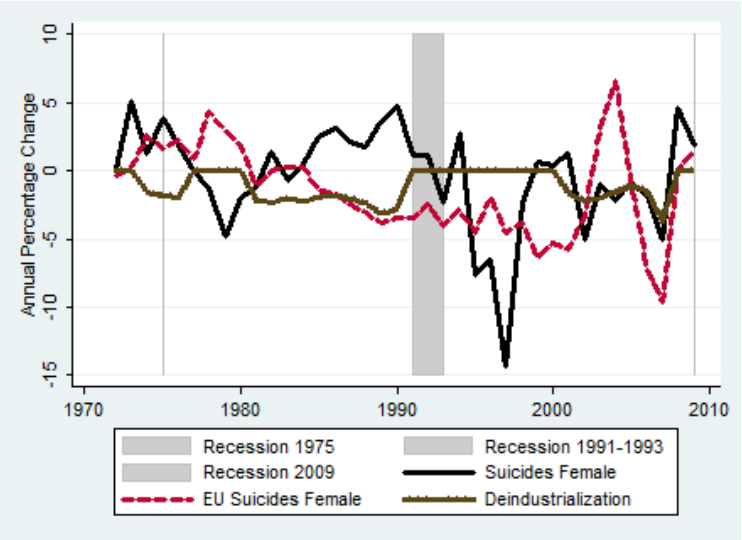
Annual change -moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure 5.11 *Suicides male Finland*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

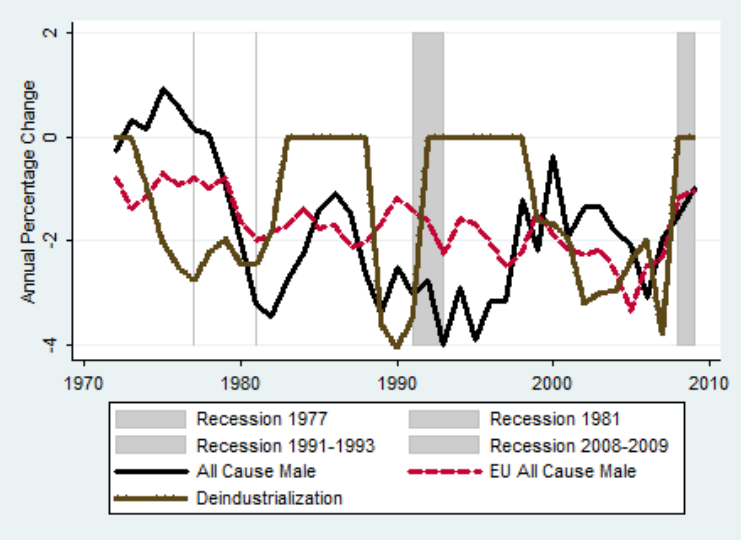
Figure 5.12 *Suicides female Finland*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

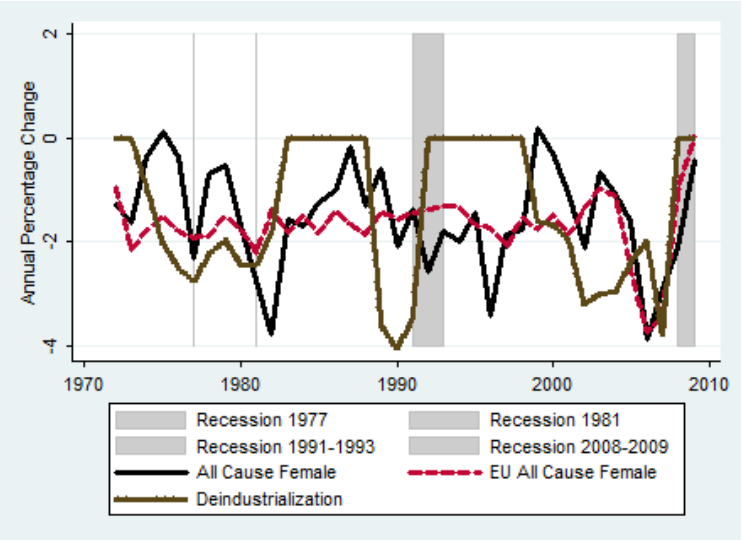
Above average deceleration appears also in the female Swedish population during the same periods. Female deaths due to suicides appear to increase during the 1980s for both countries and 2000s for Sweden. Fluctuations in male suicides are developed during the 1970s and 1980s accompanied by periods of industrial contraction in Sweden and Finland.

Figure 5.13 *All-cause male Sweden*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

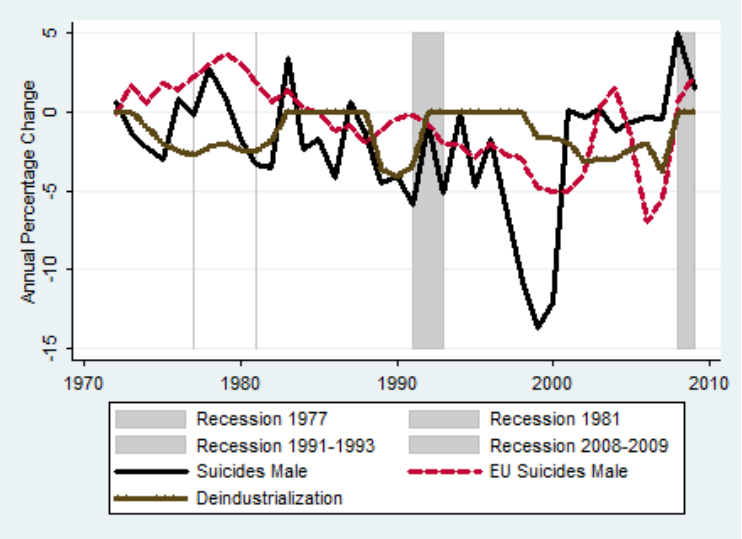
Figure 5.14 *All-cause female Sweden*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

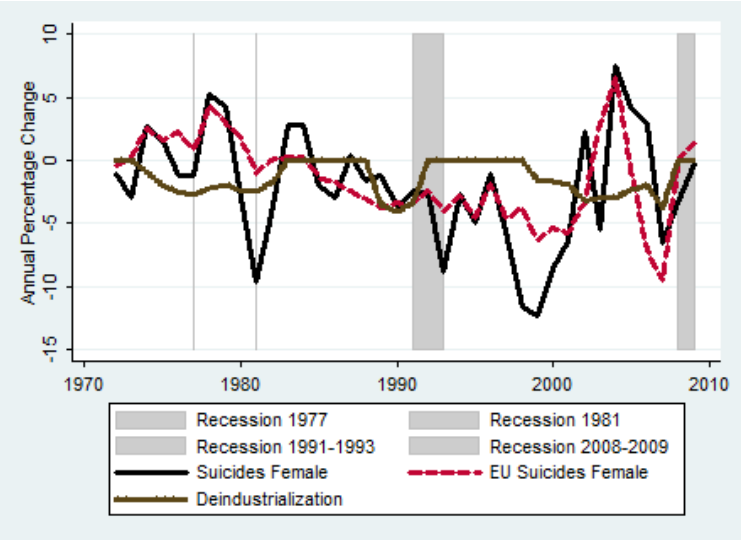
The countries, belonging in the category of above average negative industrial contraction, have demonstrated that all-cause mortality progresses independently from recession or industrial decline periods.

Figure 5.15 *Suicides male Sweden*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure 5.16 *Suicides female Sweden*



Annual change - moving average 3 years. Magnitude DZ. Source Own calculations - WHO Database

In contrast suicides, especially for males, accelerate during recession periods. Although these elements are common in these countries, however the severity and timing of industrial decline varies across countries. This suggests not only that industrial decline progresses unevenly, but it is also influenced by overall economic performances.

Exploring the trends presented in the Appendix (C,D,E) it can be revealed that all-cause mortality (males and females) in Austria and Belgium has declined accompanied with short-term decelerations mainly during the 1990s. Suicides for both genders in these countries appear to accelerate above average through combined recessionary and industrial decline periods. A similar pattern of all-cause mortality is observed in Denmark and France during the 1970s' economic downturn. In the late 1970s Denmark experiences acceleration in suicides for males and females; however for France a similar above average increase takes place in the 1990s and mid-2000s.

Concerning the remaining countries, a short increase in all-cause male and female mortality is observed in Germany and a deceleration in Greece during the 1980s. Female suicides fluctuate in both countries throughout the whole time frame but with an acute increase happening in Greece in 2000s. Male suicide rates accelerate in the 1980s, a decade of industrial and overall economic contraction for Germany

and Greece. All-cause mortality varies, during the whole period, in Ireland and Italy without revealing a specific pattern, with the exception of a rapid decrease in Italy in the 2000s. When it comes to suicides, above average accelerations take place in almost every decade and for both genders in Italy and Ireland.

For Netherlands, Norway and Portugal, all-cause female mortality demonstrates a short-term increase during the 1990s and the 1980s just for Norway. Short-term accelerations in all-cause male mortality are also observed in every country especially during economic downturns. A rapid increase in suicides (males and females) is observed in the Netherlands during the economic decline of the 1980s. However, in the case of Norway variations and accelerations in suicides do not appear to reveal a specific pattern. Finally, the last country, Portugal, illustrates a rapid rise in suicides during the economic contraction of the 1980s, whereas subsequent short rises in suicides appear mainly around recessionary periods.

In summary, these graphs reveal the unique nature of a country's industrial decline shaped by internal and external factors, mentioned in the previous section. In the same context, the industrial sector has been the main employer before the transition towards services, therefore recession periods and the magnitude of the decline cover most occupational groups. However, the rises in suicides can be strongly affected by the generosity of a country's social protection systems that might alleviate the negative consequences of industrial decline and recession periods.

5.4.1 Analysis

The data collected for the analysis are organized as time series cross-sectional data (TSCS) and follow a hierarchical form where countries represent time invariant entities (level 2) and year (1971-2009) time variant observations (level 1). Taking under consideration the nature of the data an assessment is necessary between the most common methods of analysis, random and fixed effects. Random effects modeling is able to estimate between and within effects as well as time invariant (level2) and time variant (level 1) effects of variables. However, random effects suffer from violations of omitted variables bias and the exogeneity assumption (Palta and Seplaki, 2002). In the first case, bias exists when the within and between effects are different and the between effect is ignored. In this situation the variance, caused by the omitted between (level 2) country effect, appears in the residuals and eventually

is correlated with the independent variable (covariate). That leads to a violation of the exogeneity assumption where residuals are assumed to be independent of the covariates (Shin and Raudenbush, 2010; Neuhaus and Kalbfleisch, 1998).

In order to tackle the above violations, fixed effect modeling is commonly used in various fields but also in studies examining the associations between unemployment and mortality during recessionary periods (Granados, 2005; Gerdtham and Ruhm, 2006; Stuckler et al., 2009a; Svensson, 2007). Fixed effects modeling restrain this bias since it controls for between effects and level-2 variance. However, fixed effects estimate only within effects and level-1 variance. This is achieved by the inclusion of dummy variables that comprise the level 2 variance (in this case country). Nevertheless, there are certain limitations. This type of modeling is more conservative since it estimates only the coefficients of time variant variables. Consequently, between effects (time invariant variables) could not be estimated and this leads to the loss of degrees of freedom of level-2 variables (Snijders and Bosker, 2012).

Following previous research and taking into account the above advantages and limitations, the process of the analysis adopted a fixed effects modeling and progressed in two stages. In this case, fixed effects analysis is used to remove confounding of between-country variances. In particular, this method takes into account country level differences. The next table (Table 5.3) illustrates the variables and their description included in the model. The first step of the analysis assesses the overall long-run relationship of the economic indicators on all-cause and suicide mortality. In this case, a long-run relationship is defined as whether a rise in the independent indicators is associated with a rise or fall in mortality. Long-run associations are measured in levels, which in this case are the annual rates of the economic indicators included in the model together with the dependent variable describing mortality. This occurs gradually by controlling for the independent variables together with additional general year effects, country-specific time trends and country effects.

Nevertheless, the analysis in levels does not offer the possibility to assess short-run associations. More precisely, whether changes of economic and industrial progressions (overall economic or industrial decline) can be associated with changes (rises or falls) in mortality (Stuckler et al., 2009a). Therefore, the second stage of the analysis is based on annual changes of the dependent variables and economic indicators measuring recession and industrial decline. Results are also stratified by

gender in order to identify variations between males and females.

In the same context, further analysis explores the continuous (up to three year lags) of the long and short-term (levels and changes) effects of the economic indicators on mortality fluctuations. These fixed effects models include the lags of the economic covariates and take into account year trends and country-specific time trends. Finally, more intense rises of unemployment and contractions in manufacturing (more than 1%) are also investigated. In this case the analysis includes only those years, when unemployment increases more than 1%, and the reduction in manufacturing employment and GDP per capita is more than 1%.

Before any analysis occurs the dataset has been identified as time-series cross-sectional, where country is the time invariant variable (Level-2) and year the time variant (Level-1) variable. However, the assumption of the error term, suggesting independence and identical distribution, is commonly violated in the TSCS. Therefore, the use of various methods of the Huber/White/sandwich estimator relaxes these prerequisites. The implementation of the bootstrapping method deals with the assumption of independence within clusters. The main assumption of this method is that the distribution of the data represents the underlying population (Guan, 2003). The choice of bootstrapping is based on the number of clusters. It has been indicated that for clusters less than 50, in this case there are 15, the calculation of bootstrapped standard errors are appropriate (Cameron et al., 2008). The models are estimated using the Stata version 10 software.

Table 5.3 *Description of variables*

Variables	**Description**
All - Cause Mortality	Age standardized rates (20-59 age group) Direct method/European Standard Population
Suicides Mortality	Age standardized rates (20-59 age group) Direct method/European Standard Population
Country	A string variable includes15 countries
Year	An integer variable 1971 - 2009
GDP per capita	Level of GDP per head in US dollars
Civilian Unemployment	Annual values %
Manufacturing Employment	Annual values %

Modeling

The main aim is to differentiate between long and short-term relationships of economic variations on all-cause and suicide mortality after controlling for country and time effects as well as country-specific time trends. The year effects control for determinants that vary across countries and over time, whereas country effects account for factors that differ across countries and they are time-invariant. The impact of recession and industrial decline on all-cause and cause-specific mortality is characterized by within country differences occurring in independent variables in relation to the variations taking place in other countries. The estimates of these variations account for time constant differences between countries together with factors that change over time and are distributed across countries.

The step by step modeling is described as follows:

Model 1 It is the most basic approach in levels. The first model introduces the first independent variable employment in manufacturing percentage. The model begins with the indicator describing industrial decline, since the main interest is to explore the overall association of industrial contraction and mortality. In the subsequent models the analysis takes into account periods of recession in order to examine any potential changes in the relationship between industrial decline and mortality. The model controls for country fixed effects.

Model 2 The second model introduces the overall unemployment percentage including the employment in manufacturing.

Model 3 The third model continues to control for employment in manufacturing and unemployment and introduces the next independent variable (GDP per capita). Due to skewness of the variable, transformation is necessary, therefore the log-GDP is inserted in the model. Log-GDP is included only in the model in levels.

Model 4 Model four includes a general time trend (variable year 1971-2009). It assumes that time varying indicators, for example public health, improve linearly over time at a national level (Ruhm, 2000, 2007).

Model 5 The final model controls for country-specific time trends and country fixed effects. The country-specific time trends take control for time-varying determinants within states such as demographic characteristics (Ruhm, 2000, 2007).

5.5 Results

5.5.1 All-cause and suicides levels

The following two sets of tables present the results from the fixed effects modeling. The analysis was conducted by controlling for indicators describing recession and industrial decline. The following tables (Table 5.4 and Table 5.5) illustrate the long-run association of recession and deindustrialization indicators with all-cause and suicide mortality. The first table (Table 5.4) displays, step by step, the modeling construction. Manufacturing employment has a statistical significant effect in the first, second and third models (when unemployment and GDP per capita are included).

Manufacturing employment is initially associated with a 10% rise in all-cause mortality (model 1) however this effect is reduced when additional indicators are incorporated. This indicates that further time varying factors (recession and national wealth) influence the association between manufacturing employment and all-cause mortality. On the contrary, unemployment is associated with a decrease in all-cause mortality and the association becomes stronger after controlling for general time and country-specific trends (model 5). The fact that an increase in unemployment is negatively associated with all-cause mortality, has been found in other studies (Ruhm, 2005; Granados, 2008). More precisely during economic downturns, when unemployment rises, it appears that all-cause mortality is reduced.

Finally, the log GDP per capita has a significant statistical effect on all-cause mortality even after controlling for general time trends. The log GDP per capita is associated with a decrease in all-cause mortality although the strength of this association is minimized after including time trends and country/year effects. This indicates that time-varying determinants (e.g medical improvements, public health) as well as country and time-specific factors are important and reduce the effect of national wealth on all-cause mortality.

As far as the suicides are concerned, the initial model reveals a positive and statistically significant relationship between employment in manufacturing and suicide mortality. However, when general time trends and country/year specific effects are controlled for, this relationship becomes negative; the effect is weakened and is not statistically significant. The inclusion of time-varying and time invariant indicators

Table 5.4 *All-cause mortality fixed effects - levels*

All Cause	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Man. Emp.	9.96 **	9.66 **	3.98 **	2.19	2.51*
	(8.19-11.74)	(7.71-11.61)	(0.93-7.03)	(-1.80-6.19)	(0.24-4.78)
Unemp.		-1.10	-0.99	-0.98	-1.54*
		(-2.53-0.32)	(-2.38-0.39)	(-2.40-0.43)	(-2.83;-0.26)
Log GDP			-36.14**	-19.31*	-3.98
			(-52.98;-19.29)	(-36.14;-2.49)	(-14.01-6.04)
Year				Yes	Yes
Country - Year					Yes
Country	Yes	Yes	Yes	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

operating at a national level reverses the initial positive association of employment in manufacturing and suicides. In the final model, employment in manufacturing appears to have a protective effect against suicides. This could suggest that being engaged in a sector can act as a shield against financial hardship and therefore minimize the risk of suicides.

On the contrary, unemployment is positively associated with an increase in suicides in all models. Its effect becomes stronger in the final model. This agrees with previous research suggesting that economic downturns, causing high unemployment and subsequent financial strain, are associated with rise in suicides (Svensson, 2007; Stuckler et al., 2009a). As in the case of unemployment, an increase in log GDP per capita is related to a rise in suicides. The statistically significant association is mitigated slightly when country/time specific effects are included.

Table 5.5 *Suicides fixed effects - levels*

Suicides	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Man. Emp.	0.44 *	0.52 *	0.67 *	-0.25	-0.32
	(0.03-0.85)	(0.07-0.97)	(0.00-1.35)	(-1.11-0.60)	(-1.18-0.53)
Unemp.		0.27	0 .26	0 .26	0.36*
		(-0.11-0.67)	(-0.14-0.67)	(-0.08-0.61)	(0.07-0.64)
Log GDP			0.99	9.91**	5.61 **
			(-2.69-4.68)	(5.59-14.22)	(2.81-8.41)
Year				Yes	Yes
Country - Year					Yes
Country	Yes	Yes	Yes	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

5.5.2 All-cause and suicides change

The second stage of the analysis includes the same indicators as above but the modeling is conducted in two steps. First, it is based on annual changes in the form of percentages for all-cause mortality and suicides. The next two set of tables (Table 5.6 and 5.9) present, as with the above tables, every stage of the construction of the final model. The economic indicators (manufacturing employment and unemployment) are expressed as annual changes in percent (difference in percentages) in order to examine the short-run relationship between mortality, recession and industrial decline. The second step of the analysis takes into account excessive rises more than 1% of the economic indicators used in the analysis in levels (Tables 5.7 and 5.10).

As in the previous modeling, the changing employment in manufacturing displays a positive association with all-cause mortality (model 1). A 1% point increase in unemployment is associated with a decrease in overall mortality; however the effect is not significant in all models. Finally, GDP per capita illustrates a positive and statistically significant short-run relationship with all-cause mortality. The association does not change even after controlling for other indicators and time/country effects (Table 5.6). These short-run associations indicate that business upturns are connected positively with all-cause mortality in the short-run. This was found in other studies (Neumayer, 2004; Svensson, 2007) and can be probably due to the fact that during recession periods individuals may alter their lifestyle habits by increasing their leisure time and physical exercise (Ruhm, 2000).

Table 5.6 *All-cause mortality fixed effects - annual changes in %*

All Cause	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Man. Emp.	0.23	0.17	0.15	0.16	0.17
	(-0.28-0.74)	(-0.35- 0.70)	(-0.36-0.68)	(-0.36-0.70)	(-0.42 -0.77)
Unemp.		-0.12	-0.09	-0.07	-0.08
		(-0.27 -0.01)	(-0.23-0.04)	(-0.20-0.06)	(-0.21-0.05)
GDP			0.01*	0.01*	0.01*
			(0.00- 0.02)	(0.00- 0.02)	(0.00- 0.02)
Year				Yes	Yes
Country - Year					Yes
Country	Yes	Yes	Yes	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

A decrease in manufacturing employment (more than 1%) is associated with a decrease in all-cause mortality (-0.22). Similarly, a higher increase in unemployment is also related to a fall in all-cause mortality in every model. Finally, GDP per capita displays a similar relationship with manufacturing employment and unemployment (Table 5.7). All these above associations reveal that more severe economic contractions, rising unemployment, falling employment and national wealth are associated with reduced all-cause mortality.

Table 5.7 *All-cause mortality fixed effects - changes in >1%*

All Cause	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Man. Emp.<1%	-0.22	-.09	-0.10	-0.09	-0.15
	(-1.21-0.76)	(-1.03-0.83)	(-1.03-0.82)	(-1.03-0.85)	(-1.15-0.84)
Unemp. >1%		-0.51*	-0.43	-0.42	-0.42
		(-0.99;-0.03)	(-0.96-0.09)	(-0.95-0.10)	(-0.95-0.09)
GDP <1%			-0.25	-0.27	-0.26
			(-0.69-0.17)	(-0.68-0.14)	(-0.69-0.16)
Year				Yes	Yes
Country - Year					Yes
Country	Yes	Yes	Yes	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

The subsequent table (5.8) illustrates the short and long-term effects of the lagged economic indicators on all-cause mortality. The model takes into account year trends, country-specific time trends as well as country effects. In the long and short-term, there is a procyclical association between employment in manufacturing and all-cause mortality which is statistically significant for all the three year lags and becomes stronger after the inclusion of the first lag. In both cases, the negative behaviour of unemployment and mortality is statistically significant in the first year but its effects diminishes in subsequent years. It appears that a continuous employment in manufacturing displays a positive association with all-cause mortality, whereas the protective effect of unemployment against rises in all-cause mortality is not long-lasting. The fact that economic downturns are beneficial only in the short-term has also been evident in other studies (Ruhm, 2000). On the contrary, economic growth, if sustained, can outweigh its procyclical association with all-cause mortality.

In the case of self-harm, changes in manufacturing employment are negatively related to suicides (Table 5.9). The effect of this relationship is weakened when controlling for unemployment and GDP per capita, but it strengthens again when time

Table 5.8 *All-cause mortality lagged effects*

All Cause	1 year lag	2 year lag	3 year lag
	Levels long-run		
Man. Emp.	3.20 **	3.62**	3.83**
	(1.13)	(1.10)	(1.01)
Unemp.	-1.42*	-1.18	-0.95
	(0.64)	(0.66)	(0.69)
GDP	-4.64	-6.55	-7.29
	(5.67)	(5.65)	(5.37)
	Changes short-run		
Man. Emp.	-0.24	0.53**	0.67 *
	(0.27)	(0.20)	(0.29)
Unemp.	-0.38**	-0.12	0.08
	(0.09)	(0.07)	(0.10)
GDP	-0.00	- 0.02 **	0.01
	(0.00)	(0.00)	(0.01)

Manufacturing Employment %, Unemployment %, GDP per capita. Year (1971-2009), Country*year effects. Standard errors in parenthesis. Significance levels .01 ** .05*

and country effects are included. A 1% point increase in unemployment contributes to a rise in suicides in every model. The last indicator, GDP per capita, does not seem to display a strong relationship with suicide rates.

Table 5.9 *Suicide mortality fixed effects - annual changes in %*

Suicide	Model 1	Model 2	Model 3	Model 4	Model 5
Man. Emp.	-0.65	-0.14	-0.17	-0.33	-0.31
	(-2.56-1.25)	(-1.82-1.52)	(-1.82-1.48)	(-1.96-1.29)	(-1.80-1.18)
Unemp.		1.07 **	1.12 **	0.81 **	0.80 *
		(0.38-1.77)	(0.52-1.72)	(0.18-1.44)	(0.14-1.46)
GDP			0.01	- 0.01	- 0.01
			(-0.04-0.07)	(-0.06-0.03)	(-0.07-0.03)
Year				Yes	Yes
Country - Year					Yes
Country	Yes	Yes	Yes	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

A greater fall in manufacturing is associated with an increase in suicides (3.15%), though this association is reduced with the incorporation of additional indicators. Likewise, a higher rise in unemployment displays a positive relationship with suicides. A positive connection exists for GDP per capita as well. However, in contrast to previous indicators the relationship is strengthened when year and country/time specific effects are incorporated (Table 5.10). This further supports the findings in

other studies that suicides increase during economic contractions (especially more severe) (Svensson, 2007; Stuckler et al., 2009a).

Table 5.10 *Suicide mortality fixed effects - changes in >1%*

Suicide	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Man. Emp.<1%	3.15 *	2.57 *	2.60 *	2.09	2.05
	(0.52-5.78)	(-0.04-5.18)	(-0.02-5.22)	(-0.52-4.71)	(-0.49-4.61)
Unemp. >1%		2.35*	2.06	1.55	1.51
		(-0.05-4.75)	(-0.15-4.27)	(-0.72-3.83)	(-0.82-3.86)
GDP <1%			0.98	1.35	1.44
			(-0.84-2.82)	(-0.38-3.08)	(-0.30-3.19)
Year				Yes	Yes
Country - Year					Yes
Country	Yes	Yes	Yes	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

The following table (5.11) presents the lagged effects on suicides. In the long and short-term, employment in manufacturing remains countercyclical and its effect is reduced after three years. The positive long-term association between unemployment and suicides is not statistically significant after the inclusion of the third lag.

Table 5.11 *Suicide mortality lagged effects*

Suicide	**1 year lag**	**2 year lag**	**3 year lag**
		Levels long-run	
Man. Emp.	-0.26	- 0.18	-0.11
	(0.47)	(0.49)	(0.50)
Unemp.	0.31 *	0.27*	0.22
	(0.12)	(0.12)	(0.11)
GDP	5.67 **	5.58**	5.23 **
	(1.45)	(1.58)	(1.60)
		Changes short-run	
Man. Emp.	-0.28	-0.02	0.92
	(0.82)	(0.89)	(1.37)
Unemp.	0.07	-0.14	-0.24
	(0.44)	(0.18)	(0.48)
GDP	0.03	- 0.00	- 0.02
	(0.03)	(0.02)	(0.02)

Manufacturing Employment %, Unemployment %, GDP per capita. Year (1971-2009), Country*year effects. Standard errors in parenthesis. Significance levels .01 ** .05*

Similarly changes in unemployment and GDP per capita are positively associated with suicides in the short-term but their impact on suicides becomes negative after

the inclusion of lags. On the contrary, the long-run effect of GDP per capita demonstrates a positive and statistically significant association with suicides. This occurs throughout the three year lag period although the effect is reduced.

5.6 All-cause and suicides males and females

The final section of the analysis presents the results stratified by gender based on the final model likewise with the previous tables. For male mortality, employment in manufacturing is associated with a decline in all-cause and suicide mortality. A 1% point rise in unemployment appears to have a stronger positive relationship concerning mortality due to suicides (0.71). The GDP per capita is statistically significant for all-cause mortality and it contributes to 0.01% rise. On the contrary, for male suicide mortality the increase of 1% point in GDP per capita is related to a decline of 0.03%.

Regarding the female population a 1% point increase in manufacturing employment is associated with a 0.18% rise in all-cause mortality together with a decrease of 1.75% in female suicide rates. In addition, unemployment is associated with 0.84% increase in mortality due to suicides and with a fall in all-cause mortality (-0.03). Finally, GDP per capita demonstrates a positive association with female all-cause and suicide mortality.

Table 5.12 *All-cause and suicides - males and females - change*

Indicators	**All-cause**	**Suicides**
	Males	
Man. Emp.	-0.10 (-0.98-0.77)	-0.27 (-1.70-1.15)
Unemp.	0.03 (-0.15 -0.22)	0.71(-0.00-1.42)*
GDP	0.01 (0.00-0.03)**	-0.03 (-0.10-0.02)
Year	Yes	Yes
Country - Year	Yes	Yes
Country	Yes	Yes
	Females	
Man. Emp.	0.18 (-0.31-0.69)	-1.75 (-4.43-0.93)
Unemp.	-0.03 (-0.29-0.21)	0.84 (0.21-1.48)**
GDP	0.01 (0.00-0.02)	0.02 (-0.03-0.07)
Year	Yes	Yes
Country - Year	Yes	Yes
Country	Yes	Yes

Manufacturing Employment %, Unemployment %, Year (1971-2009), Country*year effects. Confidence intervals in parenthesis. Significance levels .01 ** .05*

In the end, it appears that the employment in manufacturing demonstrates a protective effect on males compared to females. This could be due to the fact that the time range of the data covers more traditional industries that have been dominated to a greater extent by males. Therefore the benefits of being in employment influence mainly the male population. In the case of suicides, the results do not reveal significant differences between males and females.

5.7 Conclusions

The second empirical chapter has further developed the initial findings of chapter four by looking in more detail at the nature of the association between economic transitions and mortality across Europe. The purpose of this chapter has been to comparatively examine the long and short-term effects of recession and deindustrialization on all-cause mortality and suicides at an aggregate level. After considering country and time effects, as well as national wealth, overall results on all-cause mortality suggest that employment in manufacturing displays a procyclical association, whereas unemployment is countercyclical. More precisely, employment in manufacturing is positively associated with overall mortality. In contrast, unemployment is negatively related to all-cause mortality.

Even when more severe decline (more than 1%) in industrial employment occurs, together with a higher rise in unemployment, the nature of the relationship remains the same. Considering the lagged effects on all-cause mortality, in the long and short-term (levels and changes) the procyclical association with manufacturing employment appears to be continuous. However, the countercyclical relationship with unemployment weakens when the second year lag is incorporated in the analysis.

The main findings compile with previous research examining the relationship between recession and mortality. Cyclical downturns of the economy are associated with a decrease in all-cause mortality, revealing that recessions might be good for health, however this occurs only in the short-term. Nevertheless, the contribution of recession in minimizing all-cause mortality is not long lasting. This pattern occurs for several reasons. For example, during economic contractions, individuals change their lifestyle behaviour of alcohol and food consumption. Reduced working hours can have a protective effect on the population, since individuals can increase their

leisure time, exercise more and avoid unhealthy working environments and dietary habits (Ruhm, 2000, 2005; Stuckler et al., 2008, 2009a).

Regarding employment in manufacturing, the procyclical, long and short-run association with all-cause mortality implies that the engagement in industries demonstrates negative health implications. It is well established that the engagement in the industrial sector, and especially old manufacturing sector, has been associated with morbidity and mortality incidents such as cardiovascular and cancerous-related diseases (Langseth and Andersen, 2000; Tsai et al., 2001; Pira et al., 2005). However, greater falls in industrial employment have a protective effect in relation to all-cause mortality. This indicates that industrial decline can contribute to the reduction of all-cause mortality. This is not surprising since this study covers four decades, starting from the 1970s, and therefore includes the traditional industries characterized by hazardous working conditions. In addition to this, studies, using qualitative data, further support this evidence that employees who left the industrial sector reported better health and working conditions (Ostry et al., 2002). Likewise, other studies have shown a reduction in occupational injuries (Stout et al., 1996).

In the case of suicides, findings demonstrate opposing associations. During annual changes as well as more severe contractions, when a greater fall of employment in manufacturing and a rise in unemployment occur, then there is an increase in suicides. In the long-run, the most interesting finding concerns unemployment, where the positive and statistically significant effect weakens after the second year lag. The rise of suicides during economic downturns, it is not difficult to interpret since the lack of employment causes financial constraints. Economic difficulties have been associated with elevated stress and overall mental health deterioration (Svensson, 2007; Stuckler et al., 2009a).

In the context of suicides, employment can have a protective effect against financial hardship and therefore can act as a shield against suicides. However, the impact of unemployment on suicides is not long-lasting. This could further imply that the severity and duration of the harmful effects of unemployment could be mitigated by internal factors operating at a country level. For example, the generosity, duration and accessibility of social protection policies can reduce the duration and severity of the consequences of unemployment (Lundberg, 2008; Kangas, 2010; Gerdtham and Ruhm, 2006). Consequently, the universality of those safety nets can protect disadvantaged groups and, as a result, can hinder the widening of labour market

imbalances and structural transitions (Lahelma et al., 2002; Kunst et al., 2005).

Regarding the division between males and females the findings need a cautious interpretation since the employment in manufacturing refers to the whole population and it is not divided by gender due to the lack of data availability. Therefore, it is not possible to suggest any definitive interpretation. Changes of employment in manufacturing demonstrate a short-term negative association with all-cause mortality for males but not females. The manufacturing sector has been mainly dominated by males, therefore employment in the manufacturing sector appears to be more beneficial for them, at least in the short-term. Considering employment per se, evidence suggests that women can be more susceptible to undesirable life events with additional vulnerabilities created by jobs and domestic demands (Kessler and McLeod, 1984; Roxburgh, 1996). The combined factors of job-related and domestic demands can create more adverse working conditions for women compared to men. In a broader perspective, employment can be more beneficial for men since this status, especially in the industrial sector, formulates their identity and defines their role within the family (Nayak, 2006). Concerning suicides, males and females behave similarly with suicides rising during economic downturns. This agrees with the above results that include the whole population.

The main strength of this study is that it comparatively and simultaneously assesses not only the impact of recession, already examined by many studies, but also the influence of industrial decline. Furthermore, the analysis has explored not only the overall associations of the economic indicators (levels) but also has included annual changes, rapid increases as well as continuous associations. Additionally, the study has distinguished between the long and short-term effects of recessions and deindustrialization on mortality, thus providing a more complete exploration of the above associations.

In the end, this chapter concludes that deindustrialization is beneficial in relation to all-cause mortality, since employment in the manufacturing sector appears to be health damaging in the long-term. The analysis has included possible confounding factors that might influence the association between industrial decline and mortality. For example major factors such as economic shocks, medical innovations and variations among countries in social and health policies are controlled for. All these factors can be responsible for the deterioration or improvement of health outcomes, therefore the models have isolated the association between industrial decline and

mortality. Finally, the transition towards a service-based economy as well as the improvement of industrial working environments have contributed to the beneficial impact on overall mortality. In contrast, recessions can be beneficial for overall mortality only in the short-term, whereas suicides accelerate during economic downturns.

Chapter 6

Transitional effects - occupational mobility and health

6.1 Introduction

Deindustrialization constitutes a transition towards services that occurs at a national, regional and individual level. The previous chapters have explored comparatively this event across countries, whereas research so far has focused mainly on the regional implications. This chapter extends current research by exploring the transitional impacts of industrial decline across different occupational groups of individuals. In order to achieve this, this chapter focuses on the comparisons of occupational groups engaged in different sectors.

Furthermore, it simultaneously assesses the determinants of their morbidity through the transitional routes of unemployment, inactivity and re-employment. This is accomplished with the adoption of a long-term longitudinal approach by following the same individuals over time. This approach overcomes some of the limitations of the current literature. More precisely, those shortcomings are concentrated on the short-term duration of the follow-up of ex-industrial employees, small sample sizes and studies have mainly explored male and single occupational groups (Morris and Cook, 1991).

Additionally, this chapter moves beyond mortality and it explores the transitional effects on self-assessed morbidity. This occurs because morbidity includes not only the physical but also the psychological factors that might influence occupational

transitions. Therefore, morbidity variations can unravel implications regarding the nature of occupational engagement and the transitional impacts towards unemployment, re-employment and inactivity. This part of this thesis has chosen the population of Scotland. Scotland forms a good example of post-industrial case. It has undergone a more severe process of deindustrialization compared to other areas of the UK and certain countries of Europe which have shared similar post-industrial history (Walsh et al., 2010b; Leon et al., 2003).

One of the most immediate consequences of industrial decline is the closure or reduction of industries that leads to the redundancy of employees in this sector. The link between poor health and unemployment is well-established where studies confirm that redundancy is related to the deterioration of psychological and physical well-being (Bartley, 1994; Bambra and Eikemo, 2009; Eliason and Storrie, 2009). In the same context, the likelihood of moving to unemployment is more evident for those who suffer from illness and are more likely to remain in this phase for longer time compared to their healthy counterparts (Arrow, 1996; Stewart, 2001; Lindholm et al., 2001). The harmful effects of job-loss can be further developed by hazardous health behaviour (alcohol consumption, smoking, lack of exercise) and socio-economic factors (financial difficulties, anxiety) that can lead to premature mortality (Kessler et al., 1989; Eliason and Storrie, 2009; Rocha, 2001; Morris et al., 1994; Montgomery et al., 1998).

Another consequence of industrial decline is economic inactivity. Former industrial closures did not lead only to high levels of registered unemployment but also high levels of inactivity, where former industrial employees were registered as permanently sick. Young ex-miners were more likely to be registered as unemployed or be employed elsewhere, whereas older workers showed significantly higher rates of inactivity and classified themselves as permanently sick. This occurred either due to the adverse working conditions in the industrial sector or due to the lack of transferable skills of older workers that drove them to early retirement (Fieldhouse and Hollywood, 1999; Beatty and Fothergill, 1996).

Although evidence suggests that being employed can be beneficial in terms of health compared to redundancy, re-employment can have mixed effects on former industrial workers. Qualitative studies have identified positive effects of industrial decline on former manufacturing employees absorbed in similar occupations outside their industry. They experienced better physical and psychosocial work conditions

compared to those who remained in the industry. The work conditions and health benefits of re-employment in a similar job were greater for those in unskilled or semi-skilled occupations (Ostry et al., 2002).

In contrast, other studies have shown that re-employment after plant closures in less desired jobs has been associated with mental health problems such as depression and anxiety (Rocha, 2001; Kessler et al., 1989). These findings imply that the health benefits of employment status are a combination of physical and psychosocial factors related to the nature of job. Occupational engagement in less or more hazardous environments combined with issues of job satisfaction and skills mismatch can amplify the positive or negative outcomes of employment.

The purpose of the current study is two-fold. First, it aims to examine the transition from employment towards unemployment, inactivity and re-employment of the working age population in Scotland by comparing males and females employed in industries and services. It is expected that health variations exist between those employed in the industrial sector and those in the service sector since different occupations are associated with various demands and therefore subsequent morbidity implications. Beyond the health implications of occupational engagement, studies have revealed the morbidity outcomes of unemployment and inactivity. Consequently, it is hypothesized that different patterns of occupational status change, such as unemployment/inactivity and re-employment to other sectors, are associated with morbidity.

Secondly, by including individual level data, this study assesses the long-term effects of former industrial workers and services employees who became redundant in comparison to men and women still working in similar industries and services and those reabsorbed in other sectors of the economy. This chapter focuses on three main questions:

- How do transitions between employment statuses (unemployed, inactive and re-employed) affect health at an individual level?
- Is there any difference on the health effects of being out of employment between individuals previously employed in the industrial and service sector?
- Are there any health variations of employees moving between and within sectors? For example, changing occupation in the same sector or transferred from industries to services and vice versa.

6.2 Methods

The main interest of this chapter is to explore transitions across individuals engaged in different sectors, such as industries and services. In order to answer the research questions above, a longitudinal study is the most appropriate one for two reasons. First, it can follow-up the same individuals over time and second, it can explore long-term effects and causal associations. This way the health implications of the changing nature of employment among different sectors can be examined in detail. Therefore, the Scottish Longitudinal Study (SLS) is chosen for the subsequent analysis. The SLS includes two time points, 1991 and 2001.

6.2.1 Data and sample

The main sample derives from the Scottish Longitudinal Study (SLS), a large linkage study using information from the Scottish census and administrative sources (SLS-DSU, 2013). The SLS represents 5.3% of the Scottish population starting from the year 1991 census and includes 274,000 members linked with vital events (births, marriages, deaths) and health information (hospital admissions, cancer registrations). Since the main interest lies on whether occupational mobility and change in economic activity can increase the likelihood of health deterioration, the main sample includes working-age adults (20-54) employed in the year 1991.

The sample involves employed individuals who are not residents in a communal establishment and are not full time students. Residents who died or did not appear in 2001 are excluded. The outcome variable of interest concerning the health status is described by two questions in the Scottish census of 2001. The first question refers to limiting long-term illness, where the respondent can provide a positive or negative reply (yes or no).

Question 1 Limiting long-term Illness 2001 Census

Do you have any long-term illness, health problem or disability which limits your daily activities or the work you can do? Yes, No

The second question assesses the overall health and the respondent can select a reply among good, fairly good and not good. The response concerning overall health has been dichotomized as follows: good/fairly good and not good.

Question 2 Health Status 2001 Census

Overall the last twelve months would you say your health has on the whole been? Good, Fairly Good, Not Good

6.2.2 Indicators

Economic activity and sector

The selection of the main sample is based on the economic activity of the SLS members in the census year 1991. Employees in full or part-time employment, self-employed with or without employees and those on a government scheme are included in the baseline sample as employed. The second stage of the sample selection incorporates only those employed in the services and industrial sector in the year 1991. The SLS uses the Standard Industrial Classification 1992 (SIC92) and for the current research purposes it has been recorded as follows: Agriculture/Forestry/Fishing, Mining and Manufacturing, Energy and Construction and Services. Those who belong in the first category are removed from the sample.

The service sector is further divided between high and low-paid occupations. In the second category belong all these employees engaged in jobs such as sales and retail trades, hotels and restaurants, renting goods, community-social and personal services, low business activities like industrial cleaning and private households with employed persons (see Appendix F, Table F1). The choice of this division is based on research conducted by the Office of National Statistics (ONS) examining the patterns of pay of the British labour market (Holdsworth, 2010).

Employed members are followed up and this leads to the creation of a combined indicator based on economic activity and sector of the 2001 census. The population is divided among those who remained in industry (manufacturing/mining and construction/energy) and services (low and high), those who changed sector and those who progressed to inactivity or unemployment in 2001. The purpose behind this division is three-fold. First is to identify and compare the health statuses of population groups employed in different sectors. In addition, there is a great variation of skills demand and wages distribution within the service sector. Thus, it is concluded that a further separation between high and low-paid occupations is necessary. Second is to examine whether the impact of inactivity/unemployment is uniformly distributed

across the unemployed/inactive from different sectors. Finally, to assess whether re-employment in other sectors (i.e. from industries to services (high or low paid jobs) can benefit the health of the employees.

Demographic indicators

As it was mentioned above, the sample includes the female and male population aged 20 to 54 in 1991. Since the main interest lies on occupational change, the population includes all the working age people employed in services and industries. Age is given in five year intervals (20-24, 25-29, 30-34). The distribution of age into intervals could offer further insights of whether the likelihood of employment or inactivity varies between younger and older groups. As it was mentioned before, further demographic information such as marital status and gender can mitigate or accelerate the effects of employment in different sectors or change in occupational status. Therefore, this information is incorporated in the analysis. Marital status has been changed in order to contain three categories (single, married/remarried, divorced/widowed).

Socio-economic indicators

As with the demographic indicators, socio-economic information on employed individuals in services and industries is obtained from the 1991 census. Socio-economic status is constructed by five main indicators: educational qualifications, housing tenure/housing size (perceived as number of rooms), central heating and car ownership. This set of indicators has been extensively used by other studies in assessing the relationship between health status and socio-economic condition. Furthermore, diversities, between and within the industrial and service sector, concerning individuals with different levels of qualifications, types of professions and material background can further explain the likelihood of health deterioration. All these diversities are confounding indicators and need to be controlled for during the analysis in order to isolate the effects of the relationship between health deterioration, sector of employment and change of occupational status.

Therefore, an individual's educational level has been recoded as follows: First/High qualification, Non-degree qualifications and No qualifications. Additional informa-

tion concerning the respondent's economic situation is provided by the housing condition and car ownership. Housing tenure indicates whether the individual owns a property, lives in a private or social rented flat. The number of rooms (two or less rooms, three rooms, four or more), the absence or existence of heating facilities and the car ownership (yes or no) act as supplementary indicators of economic status.

Limiting long-term illness indicators

Employed respondents in the services and industries with limiting long-term illness in 1991 could have an increased likelihood of becoming unemployed or inactive by the next census compared to their healthy counterparts. This is expressed by the following question and, likewise with the 2001 census, the respondent can provide a positive or negative reply (yes or no). At this point it should be mentioned that only the variable LLTI exists in both censuses. Unfortunately, the question that assesses the health status is included only in the 2001 census and cannot be taken into account in 1991.

Does the person have any long-term illness, health problem or handicap which limits his / her daily activities or the work he / she can do?

6.3 Analysis

In order to assess the likelihood of health deterioration in the year 2001 of those employed in services and industries in the year 1991 there are two binary outcome indicators: Limiting long-term illness and health status. Having LLTI and not good health are included in the logistic model. The analysis is further adjusted by demographic and socio-economic characteristics in the year 1991. Initially, both models are adjusted by age and gender. The two final models incorporate the set of socio-economic measures mentioned above as well as pre-existent LLTI. Due to differences in economic activity between males and females further analysis is conducted separately for both genders. These stages of analysis are applied for both outcome variables that describe overall health (limiting long-term illness and health status).

The initial analysis takes into account socio-economic attributes of 1991 and overall health in 2001. However, this does not provide any information of the transition of healthy individuals towards LLTI. Therefore, further analysis is also conducted using fixed effects. The purpose for that is to focus on employees from industries and services without LLTI in 1991 but reported LLTI in the year 2001. Thus, it can be identified whether becoming unhealthy varies across sectors and employment statuses. As dependent variable LLTI is used, because it is measured for both census years. However, the sample included in the analysis, contains only the respondents who did not suffer from LLTI in the year 1991 but reported LLTI in 2001. This leads to the reduction of the sample (15258 respondents).

For the needs of the analysis the longitudinal dataset is transformed into a long form and a year variable is created. Furthermore, the respondent's ID is used as a second level variable and the year as a first level variable. Because the fixed effects are based on within individual variations, time invariant indicators, such as age and sex are excluded. For that reason, the elements of the previous combined variable based on economic activity and sector in 2001, used in the logistic regression, are separated in employment status and sector. The analysis is performed by using Stata version 11. In more detail the indicators and their categories are described in the Appendix F (Table F2).

6.4 Results

The preliminary stage of the analysis presents the socio-economic and LLTI characteristics of the respondents in the year 1991 and their transition by economic activity and sector in the year 2001. The set of tables (Appendix F) show the following groups: Remained in Manufacturing/Mining, Remained in Construction/Energy, Changed Industry and Employed in High and Low-paid services of those working in industries in 1991. Similarly of those employed in services in 1991 the categories are: Employed in industry form High and Low-paid services, Remained in High and Low-paid services and Changed Services. The last four categories are: Unemployed and Inactive from Industries, Unemployed and Inactive from High and Low-paid Services. All the above tables illustrate the absolute and relative numbers of the respondents belonging in each of the groups.

6.4.1 Descriptive information

The final sample of those individuals appearing in the 1991 and 2001 census comprises of 63,150 respondents. The number of males is 32,968 and covers 52% of the sample, whereas the number of women is 30,182 (48%). In the first set of tables (Appendix F, Tables F3 F4), employed individuals in the industrial sector (4748-14.4%) remain engaged in manufacturing and mining for both census years. The first category contains the highest number of employees of all ages. However, younger individuals previously employed in industries (manufacturing or construction), are more likely to be transferred in high or low-paid services (especially those aged 20-24) compared to the older age-groups.

Married or remarried individuals are most likely to remain in the same sector of employment, whereas those with no qualifications remain in the industrial sector. In terms of material background, those remained in manufacturing and mining in 2001 are more likely not to have a car and central heating, live in a social rented property with two or less rooms and suffer from LLTI.

The next set of tables (Appendix F, Tables F5 F6) portrays the occupational change from those employed in high and low-paid services in the census year 1991. The highest proportion of males and females across all age groups and socio-economic attributes are concentrated in the category of remaining in high-paid jobs. Most variations are observed in the remaining occupational groups. Exploring the first two categories, young employees in low-paid jobs in 1991 are more likely to be engaged in industries in 2001. Gender variations and differences at older ages are not observed for those two categories. Individuals, previously in low-paid services, are mainly single without educational qualifications, car ownership and central heating and live in social rented accommodation. These individuals demonstrate less LLTI (1.6%) compared to those who get transferred from high-paid jobs towards the industrial sector (1.9%).

Likewise, employees in the last two categories (remain in low-paid or change services) are mainly females. Most individuals who belong to younger age groups remain in low-paid jobs. Those individuals do not have any qualifications and the economic position is less desirable for those in this category. More precisely, those employees are more likely to live in a private rented flat with no central heating and

not have a car. The proportion of LLTI is higher for those who remain in low-paid jobs compared to employees who change jobs within services.

The final descriptive tables (Appendix F, Tables F7 F8) present those unemployed and inactive from the industrial and service sector (high and low-paid occupations). Among the unemployed, individuals at the older age groups (40-49 groups) and those previously absorbed in industries represent the highest percentage (1.2%). Those are possibly males, single or divorced/widowed, with no qualifications. In terms of economic background, they live in a social rented housing with two or less rooms and no central heating.

However, former employees from high and low-paid service jobs are more likely to suffer from LLTI. Among the inactive, belonging at the oldest age group, being female from the high-paid service sector and being separated or widowed demonstrate the highest percentage of inactivity. Those individuals have some form of education but no car ownership. However, they can be owners of a property of four or more rooms with central heating and show the higher percentage of LLTI. There is a similar distribution of socio-economic and demographic characteristics of inactivity between those from industry and low-paid service jobs.

6.4.2 Logistic regression

The first stage (model 1) of the analysis assesses the overall health of individuals engaged in services and industries (year 1991) by including LLTI and health status of the census year 2001 as dependent variables and is adjusted for age and sex. The second stage (model 2) controls for additional socio-economic indicators (1991 census year), whereas the final model (model 3) controls for all the above indicators including LLTI in the year 1991.

The following tables present the odds ratio and confidence intervals of the logistic models. By controlling for age and sex (model 1 Tables 6.1 and 6.2) those who are employed in low-paid services (previously employed in industry) and individuals who change occupations within the service sector are more likely to report long-term illness and not good health. However, respondents who change industry or remain in the construction/energy sector or get employed in high-paid jobs from industry show lower odds of not good health compared to those who remain in

mining or manufacturing. Concerning LLTI (Table 6.2) employees remained in the construction/energy industry or engaged in industry (previously in low-paid jobs) demonstrate also decreased probability of LLTI. Among the unemployed, those in high-paid jobs in the service sector demonstrate higher odds of not good health status and LLTI. Overall health deterioration (LLTI and not good health) is mainly observed among the inactive from industries in comparison to other occupational groups.

By adjusting for socio-economic characteristics (model 2 Tables 6.1 and 6.2) those, previously working in industries, absorbed in low-paid jobs report higher odds of not good health and LLTI. However, the highest odds of not good health are observed for those who remain in the service sector in high-paid occupations. Similarly with the initial model, individuals who change industry demonstrate the lower odds of not good health. In the case of LLTI, individuals who change service-related jobs report the highest likelihood of having LLTI. Among the unemployed, the odds of overall health deterioration increase for those unemployed from services (high-paid jobs). In contrast, inactive members from industries report greater odds of total health decline, although the odds are lower after including socio-economic indicators.

The final model (model 3 Tables 6.1 and 6.2) controls for previous LLTI together with the previous socio-economic and demographic characteristics. The odds have decreased slightly in almost every occupational group after adjusting for LLTI. Among the former industrial employees, those who moved to low-paid service jobs illustrate higher odds of not good health and LLTI. Individuals who remain in high-paid service occupations show the highest likelihood of not good health. Nevertheless, there are increased chances for LLTI for those who change jobs within the service sector compared to those who remain in the industrial sector. Unemployment from the service sector (high-paid) and inactivity from industries increase the likelihood of overall health worsening (LLTI and health status).

The findings reveal some interesting morbidity outcomes regarding the transitional effects of individuals engaged in the services and industrial sectors. Among those employed for both census years, it appears that the transition from industries to services has adverse health implications. This has been further supported in previous studies, where ex-industrial employees absorbed in low-paid jobs had to deal with issues of job dissatisfaction and skills-mismatches. In particular, low-paid service

jobs were characterized by temporal employment, low salaries and income inequalities (Wessel, 2005). Furthermore, the qualifications of ex-workers did not match the skill demands of the service jobs, which were based on more interactive and customer-related qualifications (Leidner, 1991). Subsequently, low levels of job contentment, overall job insecurity and skill mismatches are connected with several psychological implications (emotional strain, depression, anxiety) (Rocha, 2001; Wilkinson, 1994).

Table 6.1 *Logistic regression not good health*

Activity 2001	**Model 1**	**Model 2**	**Model 3**
Remained Min./Manuf.			
Remained Con./Energy	0.85(0.65-1.11)	0.83(0.64-1.09)	0.85(0.65-1.11)
Changed Industry	0.49(0.28-0.83)**	0.46(0.27-0.79)**	0.47(0.27-0.80)**
Employed H.Services (from Industry)	0.92(0.69-1.21)	0.97(0.73-1.28)	0.96(0.72-1.26)
Employed L.Services (from Industry)	1.31(0.99-1.73)*	1.26(0.95-1.66)	1.24(0.94-1.64)
Employed Industry (from H.Services)	1.01(0.69-1.46)	1.07 (0.74-1.55)	1.06(0.73-1.53)
Employed in Industry (from L.Services)	1.00(0.70-1.42)	0.94(0.66-1.34)	0.94(0.66-1.34)
Remained H.Services	1.20(1.01-1.43)*	1.46(1.23-1.74) **	1.45(1.22-1.73)**
Remained L.Services	1.22(0.99-1.49)*	1.17(0.96-1.43)	1.15(0.94-1.41)
Changed Services	1.39(1.12-1.72)**	1.40(1.13-1.74)**	1.38(1.11-1.71)**
Unemployed Industry	2.82 (2.02- 3.95)**	2.43(1.73-3.41)**	2.43(1.73-3.42)**
Unemployed H.Services	4.94(3.48-7.00)**	4.97(3.50-7.06)**	4.76(3.35-6.78)**
Unemployed L.Services	3.36(2.28-4.96)**	2.94(1.99-4.35)**	2.82(1.90-4.18)**
Inactive Industry	24.18(20.35-28.74)**	21.80(18.32-25.93)**	21.02(17.66-25.02)**
Inactive H.Services	17.22(14.52-20.43)**	18.78(15.81-22.32)**	17.93(15.09-21.32)**
Inactive L.Services	21.73(18.20-25.95)**	19.80(16.57-23.65)**	18.85(15.77-22.54)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI. Significance levels .01 ** .05*

The results from the transitional effects within sectors seem to demonstrate that changing jobs within services, low to high and vice versa, can be more health damaging compared to the industrial sector. This could possible occur for various reasons. First of all, services include many different sub-sectors and therefore they display great diversities concerning the nature of job. This could imply that every

sub-sector (within services) can be associated with different job-demands and subsequent morbidity outcomes. The current data do not offer the possibility to look in more detail those sub-sectors, thus the analysis chose a dual division (high and low-paid). This is not the case with the industrial sector, where transitions are not related to negative self-assessed health and LLTI. The nature of employment within industries is quite different, since it does not include so many sub-divisions and it is less diverse. Furthermore, the industrial sector has reduced its occupational risks and the working environment has become less hazardous compared to the industries of the past.

Table 6.2 *Logistic regression LLTI*

Activity 2001	**Model 1**	**Model 2**	**Model 3**
Remained Min./Manuf.			
Remained Con./Energy	0.99(0.83-1.18)	0.97(0.81-1.16)	1.02(0.85-1.22)
Changed Industry	1.00 (0.76-1.32)	0.96(0.73-1.27)	0.99(0.75-1.30)
Employed H.Services (from Industry)	1.17 (0.98-1.40)	1.24(1.03-1.48)**	1.23(1.03-1.48)*
Employed L.Services (from Industry)	1.29(1.06-1.56)**	1.25(1.03-1.51)*	1.24(1.01-1.51)*
Employed Industry (from H.Services)	1.14(0.89-1.45)	1.21(0.95-1.55)	1.17(0.91-1.51)
Employed in Industry (from L.Services)	0.96(0.75-1.23)	0.92(0.71-1.18)	0.92(0.71-1.19)
Remained H.Services	1.14(1.01-1.29)*	1.37(1.21-1.55)**	1.38(1.22-1.56)**
Remained L.Services	1.21(1.05-1.39)**	1.18(1.02-1.36)**	1.15(1.00-1.33)*
Changed Services	1.42(1.22-1.65)**	1.45(1.25-1.68)**	1.43(1.23-1.67)**
Unemployed Industry	2.71(2.13-3.46)**	2.40(1.88-3.07)**	2.52(1.96-3.23)**
Unemployed H.Services	4.22(3.22-5.54)**	4.30(3.27-5.65)**	4.15(3.13-5.51)**
Unemployed L.Services	3.73(2.82-4.92)**	3.36(2.54-4.45)**	3.26(2.44-4.36)**
Inactive Industry	18.77(16.48-21.39)**	17.45(15.30-19.90)**	17.92(15.66-20.49)**
Inactive H.Services	13.21(11.65-14.98)**	14.71(12.95-16.70)**	14.83(13.02-16.88)**
Inactive L.Services	16.58(14.50-18.95)**	15.65(13.68-17.90)**	15.80(13.77-18.14)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI. Significance levels .01 ** .05*

In terms of unemployment, the engagement in services (high-paid) displays the worst health outcome. Although the analysis accounted for LLTI, nevertheless the issue of reverse causation is not totally controlled for since other health-related

habits might influence the results. Furthermore, the issue of diversity within services can also contribute to the formation of these findings, since unemployment does not uniformly influence every individual. Regarding inactivity, individuals previously engaged in industries increase the probability of health deterioration as expected. In particular, the literature has already shown that inactivity has been the main transitional effect of previously employed individuals in industries (Beatty and Fothergill, 1996; Riva et al., 2011a).

The final step of the analysis takes into account gender differences (Tables 6.3, 6.4, 6.5 and 6.6). The sample is divided by males and females and the analysis takes place separately for each gender. Similarly with the above tables, the results are adjusted for demographic (only age in this case) and socio-economic indicators as well as LLTI. In the first model (Tables 6.3 and 6.4), adjusted by age, there is a protective and statistically significant effect for males and females who change occupation within industry. Lower odds for not good health (both genders) are also reported for those who remain in construction/energy industries and are employed in high-paid service jobs (from industry). Contrary to males, females report lower odds of self-perceived health by remaining in the service sector (high and low paid jobs).

In relation to LLTI (Tables 6.5 and 6.6) males who are employed in industry from low-paid service occupations report the most reduced odds of LLTI. However, males being employed in low-paid jobs (both census years) and females in those jobs (previously employed in industry 1991) demonstrate the highest probability of suffering from LLTI. Similarly with the initial analysis, unemployment, of those previously working in high-paid jobs, demonstrates increased likelihood of not good health status (males and females). Among the unemployed, males (from low-paid jobs) and females (high-paid jobs) show an elevated likelihood of reporting LLTI. Inactivity from low-paid jobs is the most severe situation for both genders and overall health (LLTI and health status), however for males this situation is inferior.

The second model controls for socio-economic factors. For male respondents, socio-economic adjustment reduced the odds of self-perceived health and LLTI but only for certain occupational groups. However, females display an elevated likelihood of overall health deterioration in almost every occupational category. Males who remain in high-paid employment and females absorbed in industries from high-paid occupations report excessive probability of poor health status. Concerning

LLTI, the situation is the same for females; however males who change occupation within the service sector show the highest likelihood of LLTI. Unemployment from high-paid jobs appears to be the worse position in terms of health status for both sexes. Nevertheless, LLTI is more evident for unemployed males from low-paid services and females from high-paid services. The situation of inactivity is different for males and females. Inactive males from low-paid services demonstrate not good health and LLTI, whereas this occurs for females from high-paid services.

Table 6.3 *Logistic Regression not good health - males*

Activity 2001	**Model 1**	**Model 2**	**Model 3**
Remained Min./Manuf.			
Remained Con./Energy	0.93(0.69-1.23)	0.89(0.67-1.19)	0.90(0.68-1.20)
Changed Industry	0.50(0.28-0.90)*	0.47(0.26-0.84)**	0.47(0.26-0.85)**
Employed H.Services (from Industry)	0.89(0.63-1.24)	0.95(0.68-1.33)	0.94(0.67-1.32)
Employed L.Services (from Industry)	1.28(0.92-1.78)	1.23(0.88-1.71)	1.22(0.88-1.70)
Employed Industry (from H.Services)	0.85(0.53-1.37)	0.93(0.58-1.49)	0.92(0.57-1.47)
Employed in Industry (from L.Services)	0.89(0.56-1.41)	0.83(0.52-1.31)	0.82(0.52-1.31)
Remained H.Services	1.08(0.87-1.34)	1.41(1.13-1.75)**	1.40(1.13-1.75)**
Remained L.Services	1.20(.93-1.55)	1.15(0.89-1.50)	1.13(0.88-1.47)
Changed Services	1.13(0.83-1.55)	1.18(0.86-1.61)	1.15(0.84-1.58)
Unemployed Industry	2.87(1.97-4.18)**	2.37(1.62-3.46)**	2.37(1.62-3.46)**
Unemployed H.Services	4.37(2.80-6.82)**	4.42(2.82-6.94)**	4.34(2.76-6.81)**
Unemployed L.Services	3.81(2.37-6.13)**	3.21(1.99-5.17)**	3.12(1.93-5.04)**
Inactive Industry	28.58(23.32-35.02)**	25.07(20.42-30.77)**	24.06(19.59-29.55)**
Inactive H.Services	18.32(14.85-22.61)**	20.25(16.34-25.06)**	19.22(15.52-23.81)**
Inactive L.Services	33.90(26.87-42.78)**	29.03(22.95-36.73)**	26.83(21.18-33.99)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI 1991. Significance levels .01 ** .05*

The final model is adjusted for all the above confounding factors including LLTI in the year 1991. Controlling for LLTI led to a slight reduction of health deterioration in most employment statuses. Lower odds for unhealthy status are observed for those who changed industry (both genders) and for males who got employed in the industrial sector in 2001 (from services-high and low). For females lower odds are

detected for women who are observed in high-paid occupations (from industries) and those who changed industries. Males who remain in the service sector (high-paid occupations) and females employed in industry (from high-paid jobs) illustrate the highest probability of not good health. In relation to LLTI, decreased chances are detected from those who are employed in industry (from low-paid services) and those who change industry for males and females respectively. For male respondents remained in high-paid services jobs and for women who changed service jobs the odds for LLTI are the highest compared to the reference group.

Table 6.4 *Logistic regression not good health - females*

Activity 2001	**Model 1**	**Model 2**	**Model 3**
Remained Min./Manuf.			
Remained Con./Energy	0.85(0.33-2.19)	0.94(0.36-2.41)	0.96(0.37-2.48)
Changed Industry	0.62(0.14-2.62)	0.63(0.15-2.68)	0.65(0.15-2.77)
Employed H.Services (from Industry)	0.86(0.52-1.42)	0.92 (0.55-1.52)	0.93(0.56-1.54)
Employed L.Services (from Industry)	1.18(0.71-1.95)	1.14(0.69-1.89)	1.11(0.67-1.85)
Employed Industry (from H.Services)	1.22 (0.66-2.26)	1.31(0.70-2.43)	1.29(0.69-2.40)
Employed in Industry (from L.Services)	0.95(0.53-1.68)	0.96(0.54-1.71)	0.99 (0.56-1.76)
Remained H.Services	0.95(0.69-1.32)	1.14(0.82-1.58)	1.15(0.82-1.59)
Remained L.Services	0.91(0.64-1.30)	0.91(0.64-1.30)	0.92(0.64-1.31)
Changed Services	1.11(0.78-1.59)	1.15(0.80-1.64)	1.16(0.81-1.67)
Unemployed Industry	2.78(1.31-5.89)**	2.78(1.31-5.90)**	2.84(1.33-6.07)**
Unemployed H.Services	4.72(2.66-8.37)**	4.86(2.73-8.65)**	4.46(2.49-8.00)**
Unemployed L.Services	2.11(1.06-4.18)*	2.03(1.02-4.04)*	1.91(0.95-3.85)
Inactive Industry	12.82(9.16-17.95)**	12.23(8.73-17.14)**	12.06(8.59-16.93)**
Inactive H.Services	12.03(8.75-16.54)**	13.44(9.75-18.52)**	13.21(9.58-18.22)**
Inactive L.Services	12.93(9.38-17.83)**	12.68(9.18-17.50)**	12.59(9.11-17.40)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI 1991. Significance levels .01 ** .05*

Among the unemployed individuals and especially males previously occupied in high-paid services demonstrate elevated chances of not good health. Male unemployment from low-paid services and female redundancy from high-paid services demonstrate the highest odds of LLTI. Finally among the inactive, male and female

inactivity from low-paid services increases the likelihood of LLTI, whereas inactive females from high-paid occupations and males from low-paid jobs report not good health.

Table 6.5 *Logistic regression LLTI - males*

Activity 2001	**Model 1**	**Model 2**	**Model 3**
Remained Min./Manuf.			
Remained Con./Energy	1.04(0.87-1.25)	1.01(0.84-1.22)	1.06(0.87-1.28)
Changed Industry	1.08(0.81-1.43)	1.02(0.77-1.36)	1.05(0.78-1.40)
Employed H.Services (from Industry)	1.10(0.90-1.36)	1.19(0.96-1.46)	1.16(0.94-1.45)
Employed L.Services (from Industry)	1.20(0.95-1.50)	1.16(0.92-1.45)	1.16(0.92-1.47)
Employed Industry (from H.Services)	1.05(0.78-1.40)	1.13(0.85-1.51)	1.09(0.81-1.47)
Employed in Industry (from L.Services)	0.92(0.68-1.24)	0.87(0.64-1.18)	0.86(0.63-1.17)
Remained H.Services	0.98(0.85-1.14)	1.23(1.06-1.42)**	1.23(1.06-1.43)**
Remained L.Services	1.26(1.06-1.50)**	1.23(1.03-1.46)**	1.18(0.99-1.41)
Changed Services	1.21(0.98-1.48)	1.26(1.02-1.55)*	1.19(0.96-1.47)
Unemployed Industry	2.74(2.10-3.57)**	2.39(1.83-3.12)**	2.50(1.90-3.29)**
Unemployed H.Services	3.35(2.37-4.73)**	3.46(2.43-4.91)**	3.47(2.41-4.99)**
Unemployed L.Services	4.48(3.22-6.22)**	3.97(2.85-5.54)**	3.89(2.76-5.48)**
Inactive Industry	21.80(18.67-25.44)**	20.14(17.22-23.54)**	20.71(17.64-24.31)**
Inactive H.Services	13.72(11.71-16.06)**	15.53(13.22-18.25)**	15.59(13.21-18.40)**
Inactive L.Services	24.59(20.20-29.93) **	22.03(18.06-26.87)**	21.49(17.52-26.35)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI 1991. Significance levels .01 ** .05*

In terms of gender variations, it appears that the transition from services (high and low) to industries has a protective effect for males, whereas for females, who remain in the services (high-paid), report not good health. These findings seem to imply that gender differences exist between males and females. The industrial sector has been traditionally dominated by males, whereas employment in the services sector did not match the skills or benefits of previous employment. On the contrary, females have been usually engaged in the services, where these type of jobs have been considered as more *feminised* (Leidner, 1991). Additionally, employment in high-paid services does not have the same impact for males and females. This could

be due to the fact that males have higher expectations compared to women, thus women are more satisfied at work (Roxburgh, 1996).

Unemployment and inactivity influence males and females from low and high-paid jobs respectively. This could occur for various reasons that are related to the nature of previous employment (financial and emotional strain, job demands) and also the likelihood of future occupational engagement. Becoming unemployed or inactive from a declining or growth sector can increase or reduce the likelihood of future career prospects and create additional diversities regarding an individual's perception of the transition towards unemployment or inactivity (Kletzer, 1998, 2005).

Table 6.6 *Logistic regression LLTI - females*

Activity 2001	**Model 1**	**Model 2**	**Model 3**
Remained Min./Manuf.			
Remained Con./Energy	0.56(0.24-1.31)	0.61(0.26-1.44)	0.65(0.27-1.53)
Changed Industry	0.51(0.16-1.67)	0.53(0.16-1.72)	0.56(0.17-1.84)
Employed H.Services (from Industry)	1.26(0.88-1.79)	1.35(0.95-1.92)	1.41(0.98-2.02)*
Employed L.Services (from Industry)	1.40(0.97-2.04)	1.36(0.94-1.98)	1.33(0.91-1.95)
Employed Industry (from H.Services)	1.30(0.81-2.09)	1.40(0.87-2.24)	1.38(0.85- 2.24)
Employed in Industry (from L.Services)	0.92(0.59-1.44)	0.93(0.59-1.46)	0.99(0.63-1.56)
Remained H.Services	1.11(0.86-1.42)	1.31(1.02-1.69)*	1.35(1.04-1.74)*
Remained L.Services	0.98 (0.75-1.29)	0.99(0.75-1.30)	1.01(0.76- 1.33)
Changed Services	1.34(1.02-1.75)*	1.39(1.06-1.82)**	1.44(1.09-1.90)**
Unemployed Industry	2.54 (1.37-4.70)**	2.56(1.38-4.74)***	2.76(1.47-5.17)**
Unemployed H.Services	5.46(3.48-8.57)**	5.62(3.56-8.87)**	5.24(3.26-8.41)**
Unemployed L.Services	2.19(1.28-3.74)**	2.12(1.24-3.64)**	2.05(1.17-3.59)**
Inactive Industry	12.28(9.40-16.02)**	11.89(9.10-15.54)**	12.34(9.40-16.22)**
Inactive H.Services	11.32(8.83-14.51)**	12.78(9.94-16.42)**	13.26(10.27-17.13)**
Inactive L.Services	12.68(9.85-16.32)**	12.67(9.83-16.32)**	13.32(10.29-17.24)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI 1991. Significance levels .01 ** .05*

6.4.3 Fixed effects

The purpose of the second step of the analysis is to explore the transitions towards illness. Therefore, the population of the employed and healthy individuals is included. Likewise with the initial analysis a step by step model building takes place for the whole population employed and not reported LLTI in 1991 (15258 respondents). The first model takes into account the employment status (employed, unemployment, inactive) and sector of employment (industry and services).

The second model controls for socio-economic attributes and the final one controls for year effects included as a dummy variable. Since fixed effect models estimate only variations occurring within individuals, therefore gender and age are considered time invariant indicators (Table 6.7). All the models are conducted by using the XTLOGIT command and include robust standard errors by implementing the bootstrap option.

The first model accounts only for employment status and sector of employment. Being inactive and working in high-paid service-related occupations increase the likelihood of LLTI. The second model is adjusted for socio-economic indicators and results in the reduction of having LLTI for the inactive. Among the different sectors, working in low-paid jobs can contribute to the appearance of LLTI. Finally, after controlling for year effects (time as dummy variable), this leads to further reduction of the likelihood of LLTI. Being inactive still shows the highest odds of having LLTI.

In contrast, working in the energy industry and high-paid jobs seems to have a protective effect against illness. However, this is not statistically significant anymore. This analysis agrees with the previous findings that the transition from employment towards inactivity is associated with elevated LLTI. Contrary to previous results, the transition towards low-paid jobs is associated with increased LLTI. Those findings have revealed that the nature of employment has morbidity implications that do not uniformly unfold across employed, unemployed or inactive individuals. The service sector is displaying an elevated risk of self-perceived morbidity.

Table 6.7 *Fixed effects LLTI*

Indicators	**Model 1**	**Model 2**	**Model 3**
		Employment status	
Employed			
Unemployed	22.22 (10.69-46.16)**	13.23(6.25-28.02)**	3.45(1.65-7.23)**
Inactive	101.39(74.00-138.92)**	72.10(52.63-98.76)**	14.91(10.71-20.76)**
		Sector	
Manuf./Min.			
Con./Energy	1.27(0.94-1.70)	1.15 (0.82-1.61)	0.90(0.58-1.38)
High-Paid Services	1.89(1.53-2.33)**	1.56 (1.22-1.99)**	0.98(0.73 -1.31)
Low-Paid Services	1.84(1.49-2.28)**	1.68(1.33-2.13)**	1.01 (0.75-1.36)

Source SLS. Model 1: employment status & sector, Model 2: employment status, sector & socio-economic, Model 3: employment status, sector & socio-economic, year effects. Significance levels .01 ** .05*

6.5 Conclusions

The current study focused on the working age population of Scotland by including individual level longitudinal data. Emphasis is placed on the health implications of occupational transitions of employees previously engaged in the industrial and service sectors. More precisely, attention is given to the shift in employment status from work to unemployment, inactivity and re-employment in similar or different sectors. The longitudinal nature of the data offers a long-term perspective in exploring the association between deindustrialization and health compared to ecological and qualitative information found in other studies. Furthermore, the longitudinal analysis has controlled for confounding factors that might influence the results. In summary, the industrial sector demonstrates a protective effect against overall self-perceived morbidity. In particular, occupational mobility within the industrial sector and the transition from low-paid jobs towards the industries do not negatively influence health. On the contrary transitions within services have revealed opposing results.

These findings have implied several issues regarding the changing nature of employment. First of all, the industrial sector has been considered as a precarious working environment and has been connected with several health implications and elevated mortality (Jones et al., 2009; Alder et al., 2006). However in terms of self-assessed morbidity, which constitutes a good indicator of premature mortality

(Bentham et al., 1995), the industrial sector has a protective effect. This could be explained if the time-frame, included in this study, is considered. It covers two time points (1991 and 2001), which take into account recent and more technologically advanced industries. Subsequently, it can be implied that the modern industrial sector has become more safe for the employees and the overall nature of employment per se has changed towards a more improved pattern of working conditions.

On the other hand, the service sector includes various sub-sectors and therefore illustrates extensive internal diversity and income inequalities (Wessel, 2005). Consequently, the transition towards low-paid jobs (from industries) has been accompanied by inferior salaries, loss of health insurance, job insecurity and temporal engagement for ex-industrial employees (Rocha, 2001). Although these elements are not directly measured in this analysis, however the measurement of morbidity covers indirectly those issues. More precisely, the measurement of overall health, used in the study, is based on the individual's judgment and perception, thus it describes different aspects not only of physical but also psychological health (Mackenbach et al., 1994).

Considering the above elements, the status of being in employment together with the nature of work as well as overall job satisfaction can influence the respondent's assessment of health. Elements such as income and qualifications, job security and promotion prospects enhance occupational contentment (Dickey et al., 2011). For example, previous studies have demonstrated that employees in high-paid professions, such as managerial, are more satisfied compared to employees in low-paid occupations (Brown and McIntosh, 2003). This is not encountered in the low-paid services where jobs were less satisfactory for former industrial employees, skill mismatches were noticeable and the benefits were inferior (Power, 2008).

Furthermore, elevated levels of job strain of occupations that entail factors like high demands, long hours and low support from colleagues have been connected with emotional and physical exhaustion as well as overall imbalance of personal and work life (Stansfeld et al., 1995; Sekine et al., 2009). Furthermore, employees involved in monotonous and sedentary jobs have reported symptoms of musculoskeletal disorders (Lundberg, 1999). As a result, these components of the service sector jobs might offer some explanation of why the service sector is possibly connected with various morbidity outcomes.

In terms of gender differences, the protective effect of the industrial sector applies for males but not to the same extent for females where occupational change occurs mainly within the services. This is not surprising since the industrial sector has been dominated by males. In parallel to this, historically, females were more likely to enter the service sector compared to their male counterparts. This has mainly occurred under two circumstances. First, due to the fact that industrial employees did not acquire, in some cases, the necessary transferable skills for non-manual occupations. Secondly, these jobs have been traditionally occupied by females, thus there were not perceived by males as the most suitable occupation (Benedict and VanderHart, 1997; Leidner, 1991). The current findings have showed that there is an increased likelihood of male morbidity (for males previously engaged in industries) during their transition to low-paid service jobs. The industrial sector can be perceived as a health threating place. Nevertheless, it offered a sense of coherence, unity and job security combined with satisfactory salaries for employees even with low qualifications.

Considering the most surprising findings of this study, being unemployed from highly rewarded occupations and remaining in the high-paid services increases the probability of self-defined morbidity. This may be a result of various factors influencing this occupational group. As it was mentioned before, extensive diversity exists in the service sector. The analysis separated the high and low income occupations. However, additional separation might be necessary in order to examine in more detail further sub-sectors of the high-paid sector. Secondly, although this study controlled for pre-existing LLTI, nevertheless this result can be influenced to a certain extent by reverse causation. For example, there is no additional information of self-perceived morbidity like health habits (diet, alcohol consumption, smoking) that might influence subsequent negative health outcomes.

Furthermore, unemployed and inactive individuals are more likely to define themselves as not healthy compared to the employed. Likewise, ill-health enhances the likelihood of an individual becoming and remaining unemployed (Korpi, 2001). In terms of inactivity, male individuals previously working in industries display higher chances of suffering from overall morbidity. These results agree with previous studies suggesting that inactivity is the main outcome of industrial decline, especially among older industrial employees not being able to be absorbed elsewhere (Beatty and Fothergill, 1996; Fieldhouse and Hollywood, 1999).

Thirdly, research has revealed that working class individuals are more likely to describe their health status as good compared to middle class individuals. Middle class individuals have higher expectations of health and can possibly identify symptoms at an earlier stage compared to lower social classes that might normalize these symptoms. Likewise, the everyday job demands and re-employment prospects are different between and within sectors and occupations (Blaxter, 1997).

The main limitation of this study is that it does not include additional morbidity indicators such as hospital admissions. The choice of self-assessed morbidity lies in the fact that this indicator includes both the physical and psychological evaluation of health. Furthermore, this indicator can have implications related to occupational engagement. However, future studies should include additional indicators for a more complete understanding of the health variations among sectors. A more detailed inclusion of various sub-sectors can offer further insights of the morbidity outcomes associated with different working environments. Unfortunately, due to small numbers further division was not possible in this study.

In conclusion, most studies examining the impacts of industrial decline have used either aggregated or qualitative information and are centred on employees dismissed from industries. Thus the main contribution of the study is that it expands on the current literature by moving beyond ecological and qualitative information. The inclusion of individuals contributes in a more in depth analysis of various occupational groups and employment statuses. Another strength of the study is that the longitudinal nature of the data offers the ability of identifying causal associations. By following up the same individuals over time, changes in socio-economic, demographic and occupational attributes can be monitored. In the end, the findings have revealed that there are important transitional effects, between males and females, associated with morbidity outcomes. This implies that the nature of employment constantly changes with some sectors becoming safer as in the case of industries. On the other hand, the experience of being out of employment is not evenly perceived by individuals and it varies according to the sector of previous employment.

Chapter 7

Conclusion and discussion

7.1 Introduction

The main contribution of this thesis is that it promotes the reconceptualization of the association between deindustrialization, health and mortality. This is achieved by introducing the following elements: comparison, time, transitions and gender. The component of comparison is introduced among countries and individuals of different occupational groups. This way the uneven influence and progression of industrial decline is revealed. Regarding the element of time, it has distinguished between the long and short-term relationship of industrial decline and mortality. In terms of transitions, it has explored the transitional effects of individuals being in employment and out of employment. Finally, it has addressed the component of gender variations at population and individual levels.

The subsequent sections of this chapter summarize and synthesize the findings of the three empirical chapters. The previous empirical chapters of this thesis have been formulated around the main objectives and answered the research questions introduced in the first chapter. It continues by introducing the methodological contribution of this thesis, it documents the limitations of the information used in the analysis and discusses various ways of moderating those constraints.

The last part of the final chapter introduces a broad discussion of the dynamics of deindustrialization across different dimensions by outlining its components at national, regional and individual levels. Finally, it concludes by suggesting further directions of research.

7.2 Formulation of the objectives

The main aim of this thesis has been to explore the nature of the association between economic transitions, health and mortality by considering the case of industrial decline. The transition towards a more service-based economy has been accompanied by profound socio-economic and political alterations and progressed unevenly beyond country-level borders. Impacts of economic transitions and fluctuations have been identified at national, regional and individual levels.

At a national level, deindustrialization has occurred and developed autonomously to other events such as recessions. Nevertheless, the industrial sector constitutes a significant part of a country's economy and consequently has been shaped by business fluctuations. Economic downturns result in high levels of unemployment that lead to job insecurity for the employed and financial hardship for the unemployed. Considering this situation, studies have shown that short-term economic fluctuations have been connected with mortality variations across countries. Although industrial contraction has been more constant compared to recessions, nevertheless it can be hypothesized that the magnitude of this event can be more severe during periods of negative economic performance. As a result, periods of severe deindustrializiation can also be associated with the acceleration of certain causes of death. Therefore, national level information can assist in providing a more precise estimation of the nature of the relationship between industrial decline and mortality.

Current literature has mainly considered industrial decline as a regional event. In many cases industry has been the main employer of a region that provided a respectable living to the residents of industrial areas. Beyond the prospects of permanent employment, an industry contributed to the material and social cohesion of a community (Parry, 2003; Cummins et al., 2005). Consequently, the closure of the industries resulted in high levels of unemployment and inactivity. Overall deprivation continued to shape the upbringing and future of next generations, whereas outmigration was the ultimate solution of former industrial employees in their search of employment (Wray and Stephenson, 2012). Even at a regional level, industrial decline has not been evenly developed and not all regions have been uniformly affected. For instance the timing of the existence of an industry per se, its importance as an employer and the effectiveness of regional restructuring policies can possibly explain this diversity.

Due to the extensive research on the regional impacts of deindustrialization, this thesis explores the individual level of the uneven influence of this event. Aggregated and qualitative information imply that certain population groups, especially males, have been more susceptible to the negative consequences of industrial decline. More precisely, it has been shown that the health implications for an individual being out of employment can differ according to the sector of previous employment. Furthermore, engagement in different sectors can be associated with different health consequences that may differ between males and females. In the same context, issues of job dissatisfaction and skills mismatch have been evident among ex-industrial employees and socio-demographic attributes can act as additional factors that enhance or mitigate those impacts.

Subsequently, this thesis has simultaneously considered those causal paths (unemployment, inactivity and re-employment) and it sought to overcome the methodological limitations of the current literature. Those limitations are concentrated on the lack of comparative studies among countries and population groups as well as the lack of the elements of time and gender. This thesis proposes that deindustrialization should be conceptualized as an economic transition operating at different levels, progresses unevenly within and across countries and disproportionately shaping the health of various occupational groups. This has lead to the formulation of three objectives. At a national level the fourth and fifth chapters aimed at exploring the progression of industrial decline as well as the short and long-term association between deindustrialization and mortality and, at an individual level, the relationship between different employment statuses and morbidity.

7.3 Summarizing the evidence

7.3.1 The progression of deindustrialization

The first chapter of the empirical analysis explored the progression of deindustrialization. This thesis hypothesizes that economic fluctuations and transitions, such as recession and deindustrialization, are related to mortality variations. The industrial sector has been the main employer for many European countries, therefore this chapter examined the severity of industrial contraction that has progressed unevenly across space. The objective of this chapter has been to address the issue of the lim-

ited number of comparative studies, looking at the magnitude of deindustrialization across countries.

Consequently, the contribution of this chapter is methodological by introducing two elements. First, the necessity of adopting a conceptual framework in order to create a single measurement that leads to a typology of industrial contraction. This index measures the magnitude of deindustrialization across fifteen European countries and the typology allocates countries according to their industrial performance. Second, the terminology and determinants of deindustrialization have been characterized by extensive diversity, whereas the progression of industrial contraction has been continuous but uneven across countries. For that reason this thesis has measured deindustrialization as a three year sustained reduction of employment in manufacturing (as a share of total employment). Deindustrialization is considered a combination of decline in manufacturing employment and rising or falling unemployment that distinguishes between positive and negative deindustrialization.

This chapter included the following research questions:

1. What has been the pace and timing of deindustrialization across Europe?

2. Is it possible to detect common patterns of industrial decline across different countries?

The decline in employment in this sector has existed independently from recessions, however the magnitude of deindustrialization has been influenced by the downturn of business cycles. The results indicated that every country has undergone the process of industrial contraction and in most cases there was not any clear distinction between positive and negative deindustrialization. Deindustrialization is a complex transition characterized by uneven progression, time and magnitude across industries and countries. Nevertheless, there are some common elements across countries. Industrial decline has been relatively constant, shaped by recession periods and a combination of internal and external factors.

7.3.2 The association - deindustrialization, recession and mortality

Moving beyond the exploration of industrial performance and the overall progression of mortality, the fifth chapter examined the nature of this relationship by taking into account recession periods and national wealth. In order to define and isolate those effects, recession and national wealth indicators act as confounders that influence both industrial performance and mortality. The contribution of this chapter is concentrated on the simultaneous exploration of long-term (levels), short-term (changes) effects as well as rapid decreases of employment and continuous (lagged) associations of deindustrialization with mortality variations. By choosing all-cause mortality and suicides the chapter concluded on two main research questions:

1. What is the relative importance of national wealth, recession and industrial contraction on mortality trends?

2. Is it possible to identify the short and long-term patterns of association between deindustrialization and mortality?

Findings revealed that the long-term (levels) and short-term (changes) association between all-cause mortality and manufacturing employment is procyclical. That indicates that there is a positive association between employment in manufacturing and all-cause mortality. This could possibly suggest that the engagement in industries is associated with elevated mortality due to the exposure to hazardous working environments. Furthermore, employment per se, during economic upturns, has been linked to overall increased mortality. This could be related to the fact that during economic expansions, individuals adopt more unhealthy habits (smoking, drinking) and work for long hours. Likewise, environmental factors such as air pollution contribute to this association (Ruhm, 2003, 2007). On the other hand, employment can act as a shield against financial hardship and reduce incidents of suicides. In the same context, the consequences of unemployment are not long-lasting. However, the generosity and duration of social protection policies can mitigate the harmful effects of unemployment.

Regarding gender differences, a short-term protective effect against overall mortality is observed for males but not for females. This is not surprising since manufacturing has been mainly occupied by males and therefore might be more beneficial

for men. On the other hand, women engaged in various sectors can be more sensitive towards undesirable life events. Furthermore, the combined impact of job-strain and domestic demands play a part in the formation of more adverse working environment (Kessler and McLeod, 1984; Roxburgh, 1996). The combined factors of job-related and domestic demands can create more adverse working conditions for women compared to men. In the end, this chapter concludes that deindustrialization is beneficial in relation to all-cause mortality at a population level, whereas rapid decreases in manufacturing employment accelerate suicide mortality.

7.3.3 Transitional effects - occupational mobility and health

The contribution of chapter six has been the examination of the health implications of occupational transitions (unemployment, inactivity and re-employment) of employees previously engaged in the industrial and service sectors. It has explored the changing nature of employment within industries and services. The analysis adopted a long-term approach by including longitudinal data and took into account Scotland since it has experienced a more severe industrial contraction compared to other areas in the UK and Europe (Walsh et al., 2010a; Leon et al., 2003). The analysis controlled for demographic and socio-economic attributes as well as pre-existing LLTI. It is hypothesized that health variations are evident in individuals employed in the services and industrial sectors, whereas the changing patterns of occupational status (unemployment, inactivity and re-employment) can mitigate or enhance those variations.

1. How do transitions between employment statuses (unemployed, inactive and re-employed) affect health at an individual level?
2. Is there any difference on the health effects of being out of employment between individuals previously employed in the industrial and service sector?
3. Are there any health variations of employees moving between and within sectors? For example, changing occupation in the same sector or transferred from industries to services and vice versa.

Results have shown important health variations among employees in the industrial and service sector. Although the industrial sector has been considered an unsafe working environment, nevertheless industries demonstrated a protective effect

against morbidity, especially for male employees, whereas transitions within the services sector showed opposing results particularly for females. The industrial sector has been dominated by males, whereas the service sector used to attract mainly female employees. Those findings reveal certain issues in relation to the changing nature of employment. For example, the analysis included a recent period (1991 and 2001) of time and therefore explored more technologically advanced industries that provided safer working environments.

On the other hand, the service sector contains many sub-sectors that display great diversities (Wessel, 2005). This could imply that internal variations in services can be connected with different job-demands, levels of satisfaction, income variations, issues of temporal employment and subsequent morbidity consequences (Rocha, 2001). Even though this study did not directly measure these components, nevertheless self-assessed morbidity contains not only the physical but also psychological morbidity (Mackenbach et al., 1994). Likewise, the experience of unemployment and inactivity did not equally influence the individuals. The severity of this impact is possibly linked to the previous sector of employment (demands, emotional strain), future prospects of re-employment, other health-related habits as well as psychological factors.

7.4 Methodological strengths

The methodological importance of this thesis is focused on two main elements: comparison and time. As it was outlined in the initial chapters, current research has progressed towards the inclusion of aggregated and qualitative information, that has been mainly confined in single cases, such as countries, regions or population groups. Secondly, the literature has neglected the nature of the relationship and magnitude between economic transitions and mortality especially in the context of deindustrialization. However, this is not the case with recessions, where studies have already proposed a distinction between long, short-term associations and rapid changes in national economy (Stuckler et al., 2009a).

Considering those limitations, this thesis included comparisons among countries and occupational groups. Contrasting countries have offered further insights of the uneven progression of deindustrialization and the nature of its association with mor-

tality. Industrial contraction has been relatively constant but heterogeneous in every country examined. The magnitude of deindustrialization varied and has been influenced by economic performance at a national level. Taking into account recession periods, national wealth, cross-country differences and time effects, the analysis isolated the relationship between industrial employment and mortality. Furthermore, it simultaneously explored the short-term and continuous associations as well as rapid changes of industrial employment on mortality variations.

The analysis did not focus on regional impacts but has moved towards individual effects. Unemployment, inactivity and re-employment are the main pathways of association identified in other studies using ecological or qualitative information. Nevertheless, in this case the concurrent inclusion of those causal paths explored the morbidity consequences. This has given the possibility to assess not only the possible severe implications of unemployment or inactivity but also examine the transition from employment to similar or other sectors of the economy.

In the same context, longitudinal information adopted in chapter six offered a unique opportunity to detect vulnerable occupational groups disproportionately influenced by industrial decline. Also, the two time points used in this study (1991 and 2001) provided a long-term approach and monitored changes regarding the occupational histories of individuals. This is important for the identification of causal associations. One of the criteria in order to estimate a causal relationship between two variables, is that the one variable (cause) must precede the other variable (effect) in time (Frees, 2004). The longitudinal information offered this possibility by examining transitional effects, by controlling for socio-economic and demographic attributes and by monitoring subsequent morbidity.

One more methodological strength of this thesis is that it covered both overall and cause-specific mortality as well as self-assessed morbidity that constitutes a good indicator of premature mortality (Bentham et al., 1995). This is significant, since most studies looking at industrial decline impacts have considered mainly mortality variations. In addition to that, morbidity, self-assessed in this case, describes not only the physical condition but also psychological health of the individual (Mackenbach et al., 1994). Within this context, this measurement of self-perceived health covers a broad range of possible factors that influence the self-evaluation of morbidity. Consequently, this might impose several theoretical insights and complexities that are discussed in the following section.

In the end, the methodology used in this thesis has overcome issues of small sample sizes, selection effects and short duration of follow up of previous studies on factories closures (Morris and Cook, 1991). This was achieved, at an individual level, by adopting a long-term approach in order to assess the morbidity outcomes of industrial decline. Overall, the empirical chapters have dealt with issues of small sample sizes and selection effects by including the appropriate data and statistical methods that control for country and individual differences.

7.5 Methodological constraints

As with every piece of research there are certain limitations that must be taken into consideration and are concentrated on the nature of the information included in the analysis. Therefore, this section outlines the methodological limitations linked with the empirical chapters of this thesis. The first empirical chapter introduced an index of deindustrialization in order to measure the magnitude of this event. This measurement follows a labour market perspective as it constitutes a combined estimation of reduced manufacturing employment accompanied by fluctuations in unemployment. Although this index effectively isolates periods of industrial decline, nevertheless there is an important limitation. This index takes into account the unemployment in the whole economy and not the level of unemployment across different occupational groups. Unfortunately current comparative aggregated data covering this time range do not sufficiently offer this opportunity.

Considering the second chapter of analysis (Chapter 5), the main weaknesses are concentrated on the selection of population and the assessment of health indicators. In particular, the analysis of the relationship between industrial decline, recession and mortality includes the working age population as a whole. Although these events have occurred in many countries, nevertheless the timing and the extent vary among and within countries and population groups. For example, industrial decline might have different effects on certain populations groups especially those employed in the industrial sector compared to employees absorbed elsewhere. In contrast, recessions cause high levels of unemployment across all the sectors of the economy. However, due to the lack of detailed comparative data it was not possible to disaggregate the population by employment status (employment, unemployment) or type of employment (services, industries).

Secondly, mortality data provides an incomplete picture when it comes to the evaluation of the health impact of these events. More precisely, additional morbidity information can further contribute to a more extensive perception of how these events can influence different occupational groups within and across countries. Thirdly, the inclusion of fixed-effects controls for cross-country time-invariant differences. However, estimates of those variations can provide with more comprehensive insights regarding the mitigation or acceleration of economic transitions.

The final chapter of this thesis adopted a longitudinal approach and overcome to a certain extent the constraints of comparative research by including morbidity outcomes of specific occupational groups. The final chapter has offered the unique opportunity of exploring occupational transitions in the context of industrial contraction by considering the case of Scotland. However, in this case the data availability of the SLS is limited to the time frame of the years 1991 and 2001, thus the study misses out information on the individuals for the intervening years. More precisely, further information on occupational history could provide a clearer picture of morbidity variations.

Another issue concerns the division of occupational groups. As it was mentioned before, the service sector portrays very little uniformity even within well-paid occupations and unfortunately further divisions of the sub-sectors have not been possible. Finally, morbidity consequences are confined in self-assessed health and LLTI. Although these two elements constitute a good measure of premature mortality, nevertheless they are influenced by cultural and socio-economic factors as well as individual expectations and physical conditions (Taulbut et al., 2013). For that reason, additional measures of health-related habits (such as alcohol consumption, smoking) or hospital admissions could enhance the understanding of the variations that exist among different occupational groups.

Despite the above limitations, every empirical chapter accomplished its own objectives set in the introduction chapter of the thesis. The chapters synthesize further research directions and introduce a new research agenda not only in the context of deindustrialization but also overall economic and occupational mobility.

7.6 Concluding remarks - synthesizing the evidence

In conclusion, the evidence derived from the empirical chapters suggests that deindustrialization has been an economic transition that progresses unevenly, contains various dimensions and operates across different levels within and across countries. The main contribution of this thesis has been to recognize the complex nature of economic transitions and explore common components that exist across these levels, national and individual. Those elements have been: magnitude, time, transitions and gender. The findings suggest that the consequences of industrial contraction are not unaffected by overall economic progression. The magnitude and progression of industrial contraction has been heterogeneous across countries and strongly shaped by recessionary periods. Within this context, the element of time is introduced by exploring continuous, long and short-term associations as well as rapid changes that have influenced overall and cause-specific mortality variations.

At a national level, industrial decline, in terms of employment, appears to weaken the negative consequences of the high exposure levels to the adverse working conditions of traditional industries. Therefore, the transition from traditional industries towards a more service-based working environment has a beneficial impact on the reduction of overall mortality. However, additional environmental factors and daily health-related habits possibly influence the overall relationship between deindustrialization and mortality.

Exploring the transitional effects of employed individuals of more contemporary sectors of economy (industries and services) reveal opposing results. The contemporary industrial sector provides safer working conditions and does not negatively influence health. On the contrary, the service sector contains apparent internal diversities that alleviate morbidity incidents. Further issues concerning the nature of employment, such as levels of demands, satisfaction and control, income variations as well as temporal versus permanent employment, could further uncover the reasoning behind the formulation of these health outcomes.

Finally, gender variations of transitional effects, further reveal former patterns of the labour market. More precisely, traditional male-dominated sectors of employment, such as industries, appear to have a protective impact against health deterioration especially for males. On the contrary, the diverse gradient of the service sector influences both genders, but especially females. During the transition towards a service-

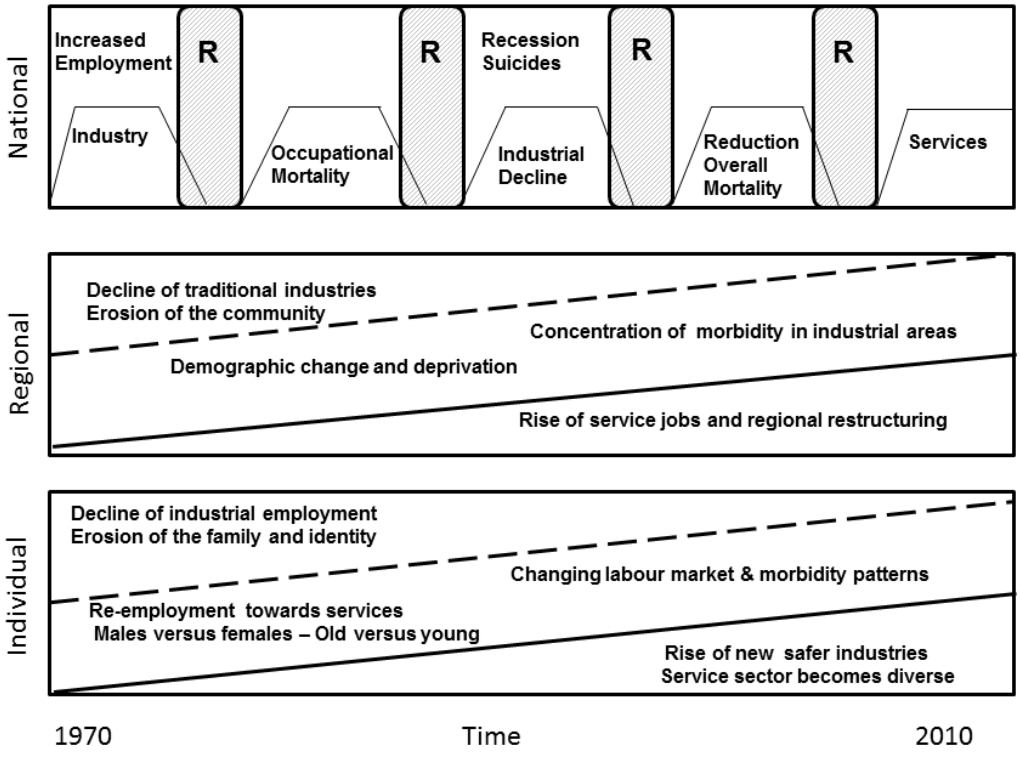
based employment, women had more chances of occupational engagement since customer-related non-manual skills were essential in this sector. Self-perceived health includes the combined effect of additional elements of job and domestic demands (bread-winner model, taking care of family). Those elements influence unequally the experience of being out of employment between males and females. In the end, this thesis revealed the complex nature of economic transitions, such as deindustrialization, that shapes a constantly changing labour market and results in a disproportionate influence of countries, regions and individuals.

7.7 Re-thinking deindustrialization

Deindustrialization has been an economic transition that has been extensively examined within different contexts and geographies. Academic literature portrays strong diversities concerning the terminology, operationalization and therefore consequences of industrial decline. This diversity indicates that deindustrialization is a complex phenomenon and it can be quite challenging to draw definitive conclusions when measuring its influence. Furthermore, it has been mainly perceived as a transition operating across a single dimension. This thesis has reflected upon those complexities and recognized that deindustrialization has not been adequately conceptualized in the broader research area that links labour market transitions and health. This has been apparent not only through the evaluation of the literature review but also through the findings of the empirical chapters.

The following schema (Figure 7.1) is a modified version of the conceptual framework introduced in the literature review. It illustrates a dynamic operationalization of deindustrialization introduced in this thesis. This is achieved by summarizing the different dimensions of this event and the components of the association between industrial contraction, mortality and health. At a national level, deindustrialization occurs by various external and internal factors. In particular, global scale industrial competition results in the outsourcing of industries towards less-developed countries that offer inexpensive labour and production procedures. On the other hand, internal factors, such as changing patterns of consumption towards more service-based goods as well as national market policies promoting the service sector, accelerated this transition. Consequently, the progression and magnitude of this change has been uneven but sustained across and within countries.

Figure 7.1 *A post-industrial era. The dynamic nature of deindustrialization*



After Fielding (2010)

Looking at the top block of the schema, this transition has been accompanied by periods of recession that accelerated the progression of the decline in manufacturing employment. Periods of recession have been associated with rises in suicide mortality, whereas reduced employment in traditional industries, demonstrating an adverse environment, has been beneficial towards overall mortality. As unemployment is the main outcome of economic downturns, the generosity of social protection, towards the unemployed individuals, is an important determinant of alleviating or minimizing the severity of business downturns and therefore industrial contraction.

Being unemployed or inactive results in economic disparities that can be evident across populations and individuals, however the severity of financial hardship depends on other components provided by welfare states. Those elements, such as overall national social security, unemployment benefits and job incentives, protect vulnerable population groups and differ across countries. As with overall business

fluctuations, the uneven magnitude and progression of industrial contraction has disproportionately affected regions and population groups.

Moving towards regional variations (second block), the importance of an industry within a region expands beyond the boundaries of occupational engagement. By providing employment and financial prosperity to the residents of a region, the industry became an element of social cohesion. Permanent employment, informal occupational relations and promotion prospects resulted in the formation of a cultural identity accompanied by cultural events, leisure activities and social gatherings. This could suggest that the significance of an industry has grown through time, since it played a dual role for generations, as an employer and a formulator of cultural identity. As a result, the closure of industries has been accompanied by elevated levels of unemployment and inactivity. The implementation of regeneration processes, for example through the creation of new service jobs and re-training of ex-industrial employees, and the overall adaptation to a new economic path were not always successful. This resulted in high levels of overall socio-economic decline, whereas out-migration, especially of young employees, was common in an effort to find alternative employment. Regional deprivation, demographic change and concentrated morbidity have been constant elements of industrial contraction through time.

The transitional effects of industrial contractions have been apparent across individuals as well (third block). Male unemployment and inactivity contributed to the erosion of family structure, causing financial constraints, and the loss of male identity. This was further enhanced by the elevated female employment in service-related jobs. Women were considered more suitable for non-manual positions, whereas male ex-industrial workers were perceiving those positions as feminine and in many cases did not obtain the necessary skills (Benedict and VanderHart, 1997; Leidner, 1991). Furthermore, the transition towards service occupations were more apparent among young individuals and characterized by low salaries, skills-mismatches and short-term contracts. These elements resulted in overall job dissatisfaction and insecurity.

Beyond the different components of industrial decline and the different levels of its progression, this thesis introduced a new dimension: the immersion of a new labour market derived from the alterations of old industrial employment patterns. At a population level, the traditional industrial sector has been considered as an adverse

working environment. Likewise, employment in this sector has been connected with various cancerous, respiratory and heart-related diseases. Nevertheless, at an individual level, the hazardous components of the industries have been counterbalanced by permanent and secure employment, inclusive benefits and promotional prospects within the industry. The long-lasting transition towards services revealed two major labour market changes.

First, industrial contraction gave rise to more technologically advanced industries that provided safer working conditions. This resulted in a reduction of occupational risks and therefore overall mortality. Furthermore, in a constantly changing working environment, modern industries do not employ only semi-skilled or unskilled employees. They attract more highly-skilled professionals, since technological innovations demand more skillful employees. Second, the expanding service sector entails numerous occupations and it could be initially considered a safer occupational choice compared to industries. However, this thesis revealed that this is not necessarily true. The extensive diversity within services disguises hidden occupational risks possibly concentrated around issues of income inequalities, duration of employment, skill mismatches, job-related strain and satisfaction. This thesis suggests that medical and technological innovations have reduced the physical risks of working environments. However, contemporary employment sectors disguise patterns of mental morbidity that should be further evaluated in future studies.

In summary, literature so far has conceptualized deindustrialization as an event occurring across a single dimension, mainly regional, causing high levels of unemployment and inactivity. The morbidity and mortality implications of those pathways have been extensively explored by including ecological information and specific occupational groups. Overall, previous research has mainly considered industrial decline as a negative event causing deprivation and erosion of the community and family structure. This thesis has progressed beyond the current findings by conceptualizing deindustrialization as a transitional and dynamic event that functions in many levels, progresses unevenly and therefore disproportionately influences mortality and morbidity outcomes at a national, regional and individual level.

More precisely, the inclusion of a typology that measures the severity of industrial decline has contributed to the lack of comparative studies exploring this progression. The magnitude of industrial decline has revealed that this event contains unique elements. For example, the vulnerability of certain countries, regions or

individuals towards economic transitions is the combined effect of socio-economic and political factors that differ across countries. However, the typology has revealed common patterns of progression across countries influenced by business cycles.

Regarding the mortality outcomes, this thesis has further advanced current knowledge by showing that industrial decline has contributed to the overall decline of mortality in the long-term, whereas rapid reductions of industrial employment increase suicides in the short-term. Relating to the morbidity implications, occupational transitions, between industries and services, have demonstrated that the health implications of a changing labour market are quite complex. For example, the contemporary industrial sector appears to have a protective effect against morbidity compared to the services. This thesis suggests that the changing labour market patterns have contributed to the alterations of morbidity patterns from physical to mental morbidity implications of employment.

This thesis concludes that the extent of those transitional effects could depend on how well-prepared the population was and how effective the transition-related processes were at national, regional and individual levels. Finally, this thesis addresses the necessity of re-defining the concept of deindustrialization, recognize the multidimensional nature of economic alterations and therefore re-evaluate the mixed consequences of industrial decline.

7.8 Future paths and suggestions

This thesis proposes that deindustrialization unevenly shapes the formulation of morbidity and mortality of the population within and across localities. Since researchers have already begun to recognize the importance of comparison across countries (for more detail see Taulbut et al. (2013)), future research should be directed towards different geographical levels and especially population groups.

In particular, further exploration of the severity of industrial decline and recession periods across countries is necessary. For example, it has been hypothesized that normal and severe economic fluctuations can be associated with different patterns of mortality. Therefore, further research should be directed towards the morbidity effects of the current recession. Recent studies have already shown, together with suicides, a rapid and unexpected increase of infectious diseases, such as the human

immunodeficiency virus (HIV), in Southern European countries affected by recessions (Karanikolos et al., 2013). This could be due to an interaction between the austerity measures and economic downturns that result in fragile social protection and health care systems.

Consequently, future studies should focus on the quantification and estimation of cross-country institutional differences. Labour market policies, inclusive social security systems and the introduction of job-driven incentives can protect against financial hardship and at the same time enhance the prospects of re-employment. In addition, looking at the progression of various protection systems provided by the welfare states, especially during acute periods of industrial decline, could also give further insights of why in certain countries these experiences were less abrupt. Finally, the inclusion of additional morbidity outcomes, as indicators of pre-mature mortality, at a national level could offer a more complete understanding of the health consequences of deindustrialization.

This thesis concluded that industrial decline has not evenly influenced countries, regions and population groups. For that reason, upcoming projects should comparatively explore more de-industrialized regions of single countries. In particular, sub-national studies can provide a more thorough evaluation of the health experience of socio-economic transitions. For example, deindustrialization has been uniquely shaped by industrial histories as well as various political and economic reforms. By taking into account a shared political and economic background among sub-national population groups and localities, additional factors can be identified. Those sub-national factors can possibly formulate subsequent morbidity patterns of the traditional and contemporary labour market.

Since this thesis proposes that deindustrialization is a transitional event, additional research should follow a longitudinal perspective of analysis. Longitudinal studies give information regarding occupational histories and, together with socio-economic and demographic data, they are more efficient in identifying causal associations and changes. More precisely, a contrast between young and middle-aged individuals engaged in different sectors as well as gender-driven approach can explore in more detail the transitional employment, household and morbidity effects of labour market alterations. As a result, additional longitudinal studies, like the British Household Panel Survey, can offer a more regular collection of information on individuals.

Beyond job-related transitions, a longitudinal approach, linked with hospital-related information, can enhance the evaluation of morbidity diversities among individuals. Consequently, a direct extension of this thesis could include further morbidity data, such as cancer registrations and hospital admissions, and cover not only Scotland but also expand in the whole United Kingdom and possibly Europe. In the same context, longitudinal studies should also entail supplementary measures of health such as dietary habits and overall lifestyle behaviour. However, as it was mentioned before, contemporary working environments have become safer against physical risks, thus future research should be directed towards mental morbidity risks of employment in various sectors of the economy.

In conclusion, the continuous rise of living standards, the change in consumption demands and patterns together with technological developments resulted in the transition from agricultural towards an industrial economy and finally a service-based economy. In certain cases, such as the UK, international competition, lack of investment in declining industries, as well as the implementation of neo-liberal economic policies have hastened this transition. However, this thesis introduced a new research agenda in the context not only of deindustrialization but overall economic transitions. Future research should move beyond these paths and explore the changing nature of employment in different sectors of the economy before and after economic transitions. Industrial contraction has been characterized by abrupt labour market imbalances linked to issues of gender-related labour participation, flexible employment and issues of job satisfaction that have not been extensively examined.

In a constantly changing economic era and demanding labour market, maybe it is time to explore in more detail the changing nature of employment per se and monitor the transitional implications of unemployment, inactivity and re-employment. In the modern world, countries and nations are connected through institutions, influenced by global policies and therefore it is challenging to isolate the impacts occurring on the population of different geographical areas. Nevertheless, subsequent studies should consider a broader perspective of economic transitions that synthesizes the changing nature of employment. This approach can lead to more targeted policies, aiming towards sector-specific employability, that will minimize negative consequences and successfully prepare the population for future transitions.

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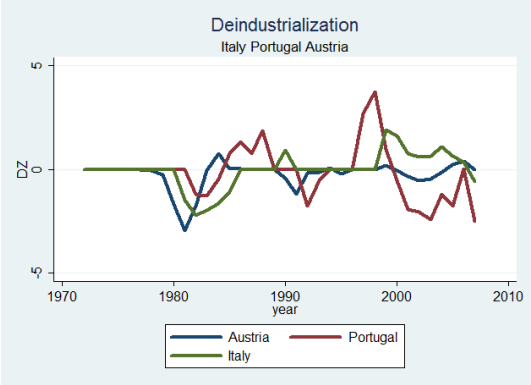
Appendix A

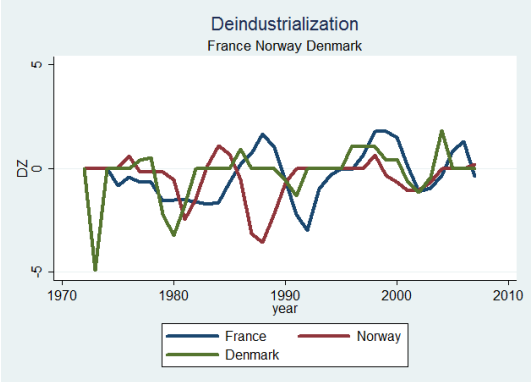
Positive and negative DZ

Figure A.1 *Deindustrialization Italy Austria Portugal*



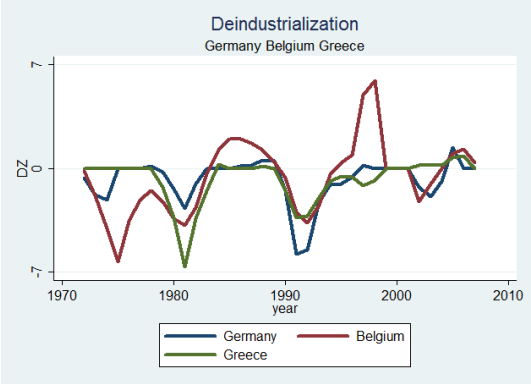
Own calculations. Positive & negative DZ. Lines above zero indicate positive. Lines below zero negative. Source STAN-OECD

Figure A.2 *Deindustrialization France Norway Denmark*



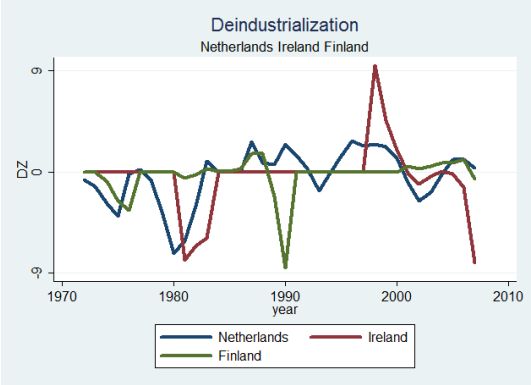
Own calculations. Positive & negative DZ. Lines above zero indicate positive. Lines below zero negative. Source STAN-OECD

Figure A.3 *Deindustrialization Germany Belgium Greece*



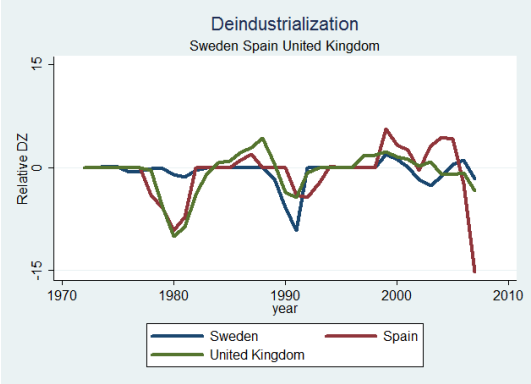
Own calculations. Positive & negative DZ. Lines above zero indicate positive. Lines below zero negative. Source STAN-OECD

Figure A.4 *Deindustrialization Netherlands Ireland Finland*



Own calculations. Positive & negative DZ. Lines above zero indicate positive. Lines below zero negative. Source STAN-OECD

Figure A.5 *Deindustrialization Sweden Spain United Kingdom*

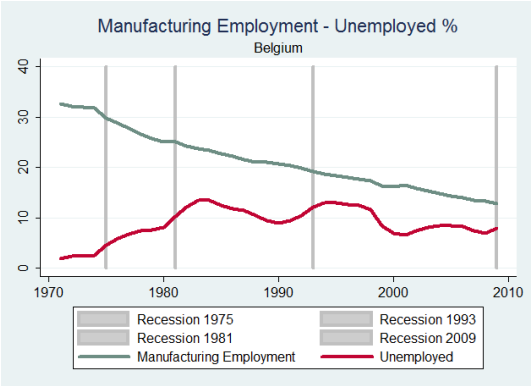


Own calculations. Positive & negative DZ. Lines above zero indicate positive. Lines below zero negative. Source STAN-OECD

Appendix B

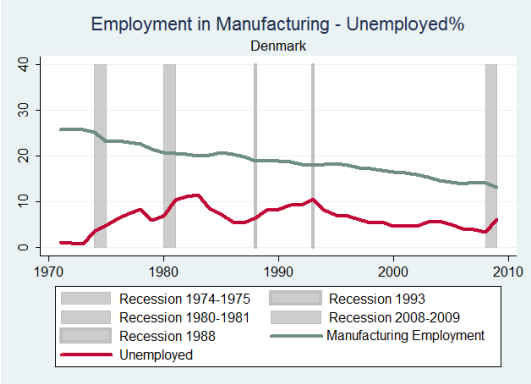
Manufacturing employment and overall unemployment

Figure B.1 *Belgium employed and unemployed*



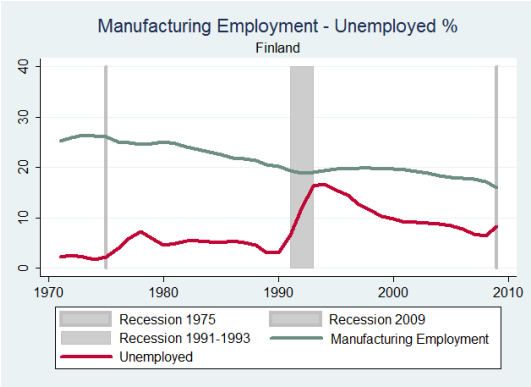
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.2 *Denmark employed and unemployed*



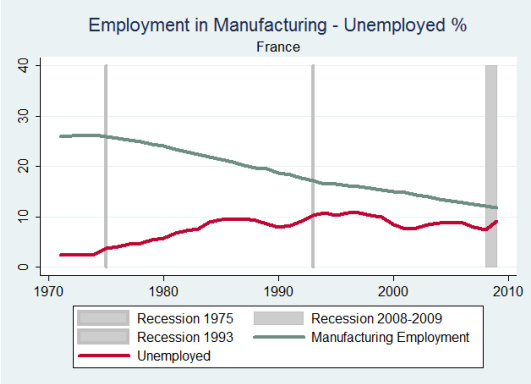
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.3 *Finland employed and unemployed*



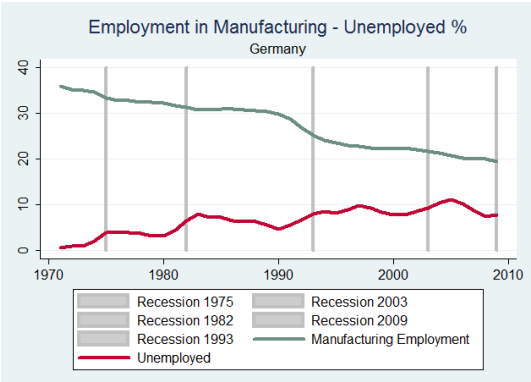
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.4 *France employed and unemployed*



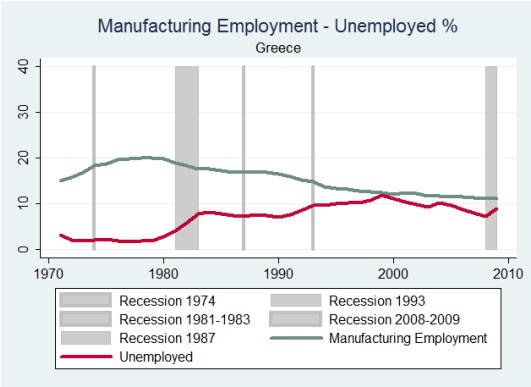
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.5 *Germany employed and unemployed*



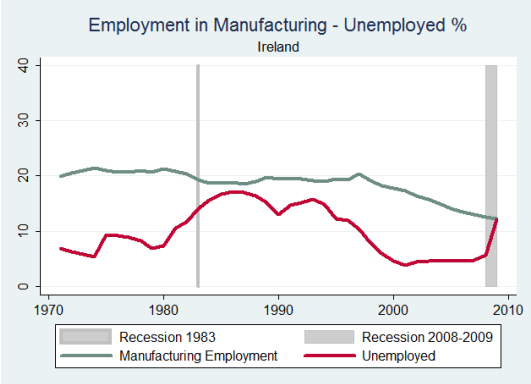
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.6 *Greece employed and unemployed*



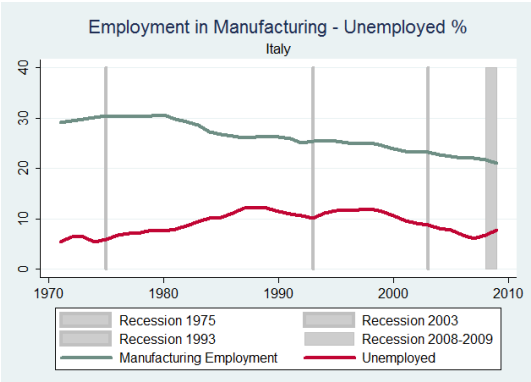
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.7 *Ireland employed and unemployed*



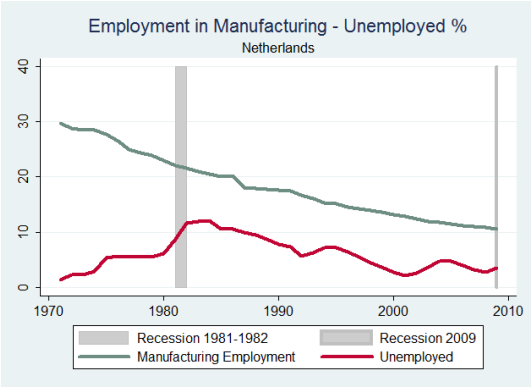
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.8 *Italy employed and unemployed*



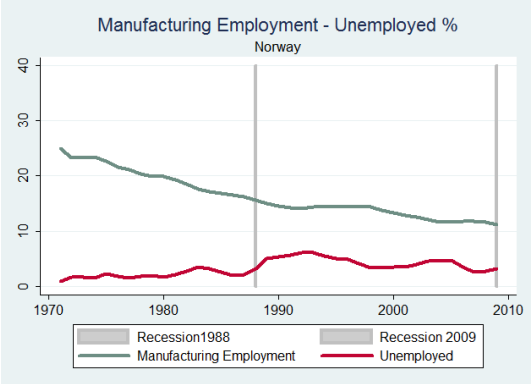
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.9 *Netherlands employed and unemployed*



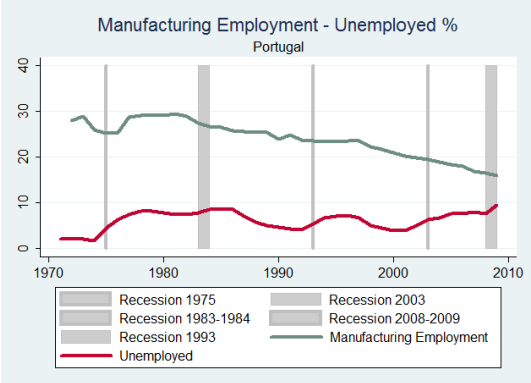
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.10 *Norway employed and unemployed*



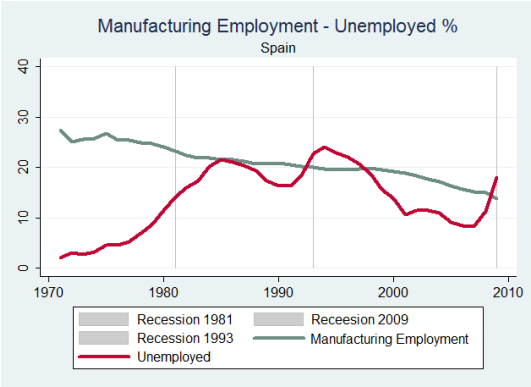
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.11 *Portugal employed and unemployed*



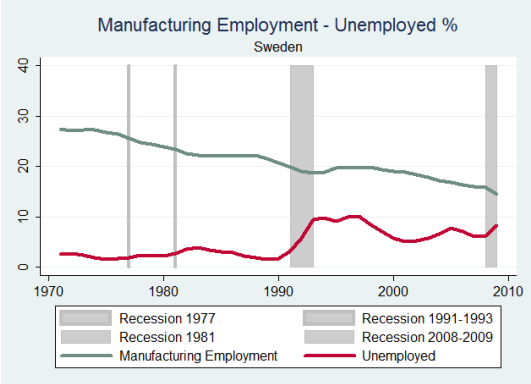
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.12 *Spain employed and unemployed*



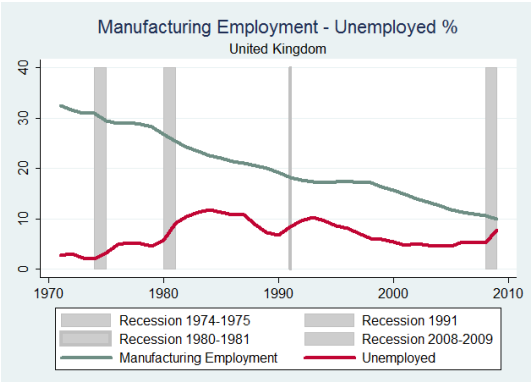
Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.13 *Sweden employed and unemployed*



Source Own calculations - OECD-Labour Force and STAN Databases

Figure B.14 *UK employed and unemployed*

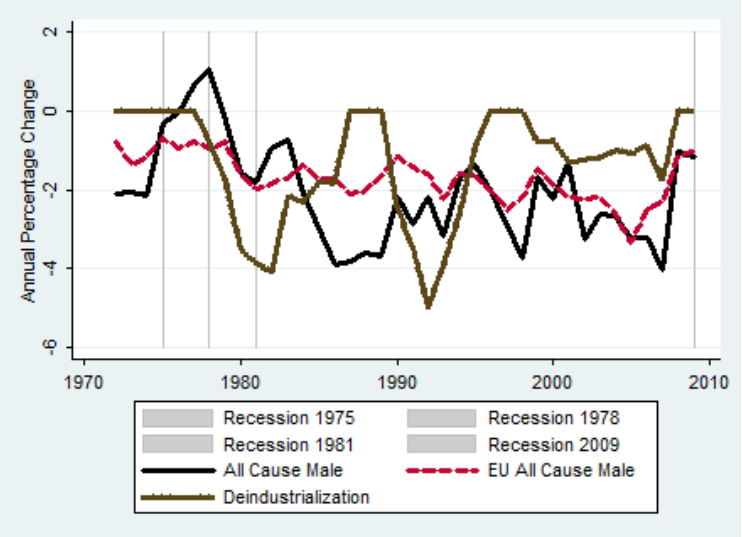


Source Own calculations - OECD-Labour Force and STAN Databases

Appendix C

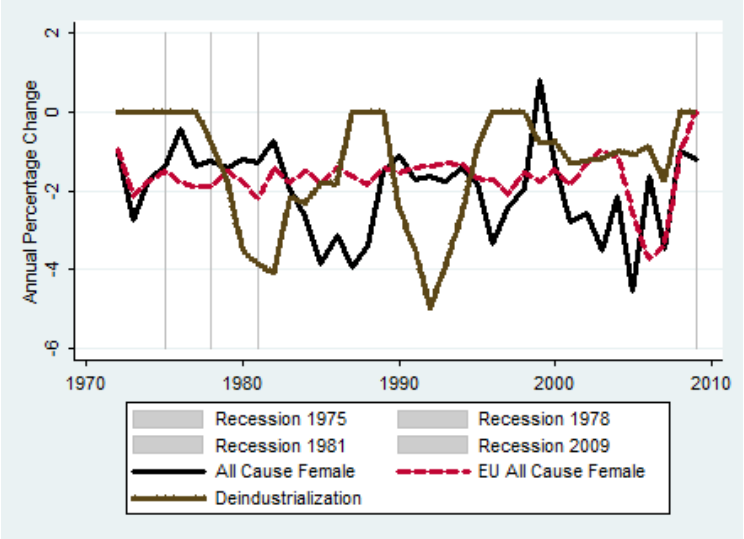
All-cause and suicides trends - Group1

Figure C.1 *All-cause male Austria*



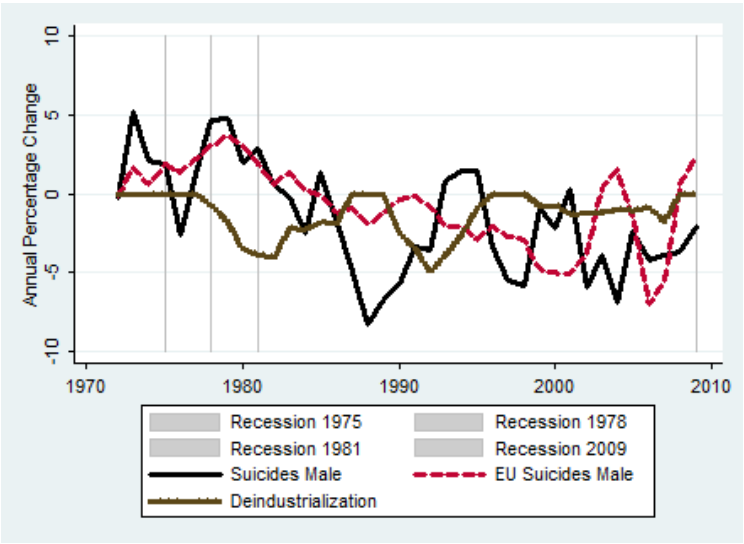
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.2 *All-cause female Austria*



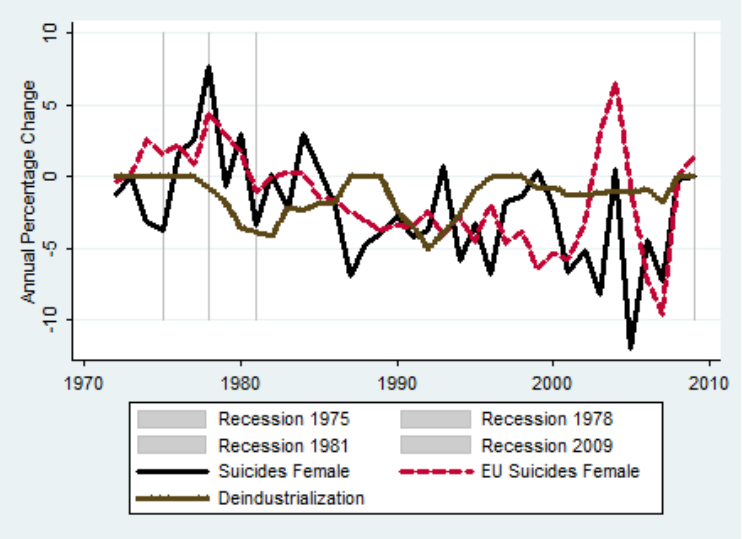
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.3 *Suicides male Austria*



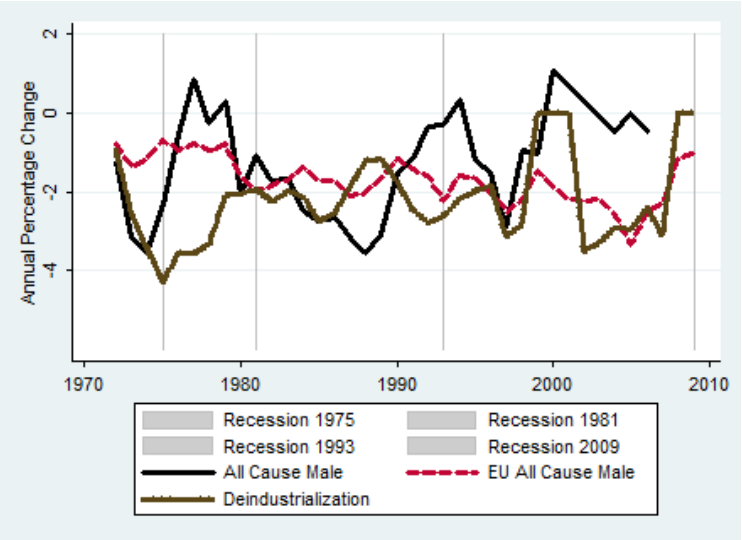
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.4 *Suicides female Austria*



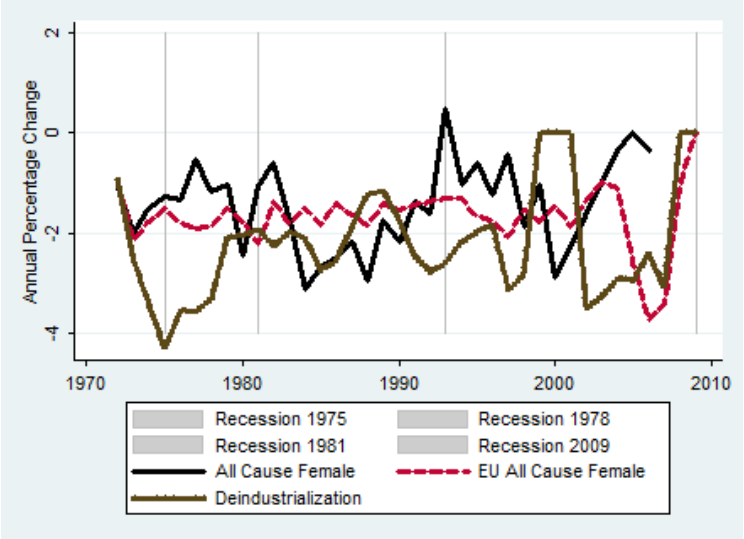
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.5 *All-cause male Belgium*



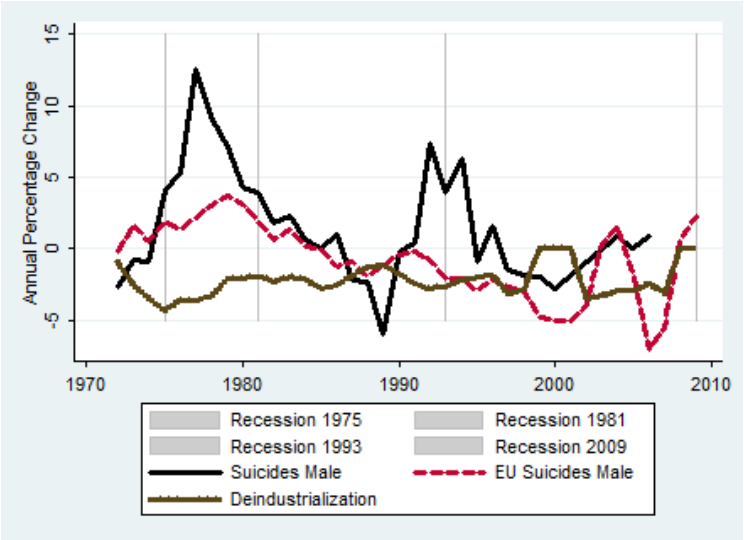
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.6 *All-cause female Belgium*



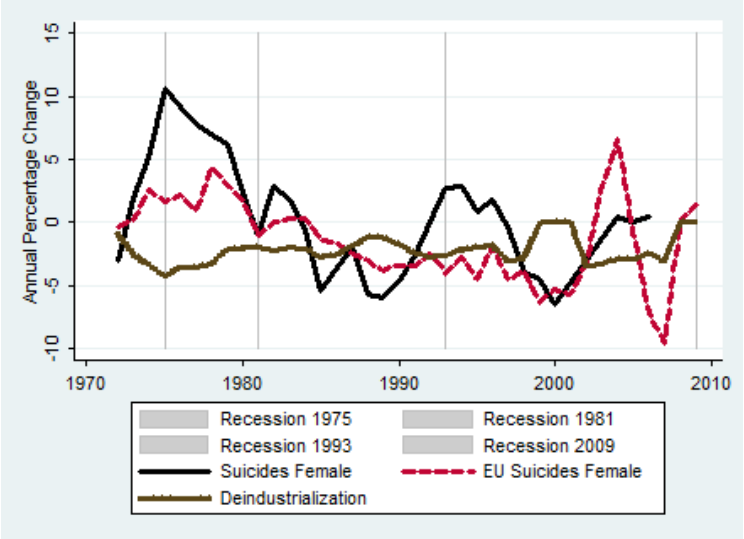
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.7 *Suicides male Belgium*



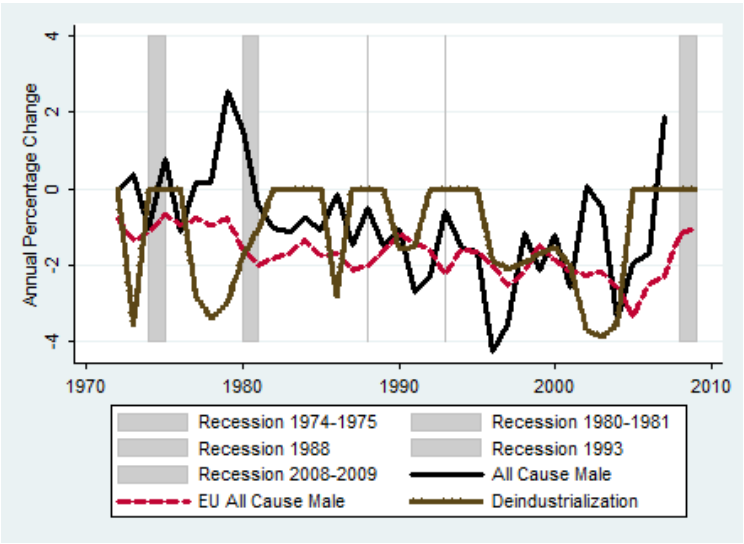
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.8 *Suicides female Belgium*



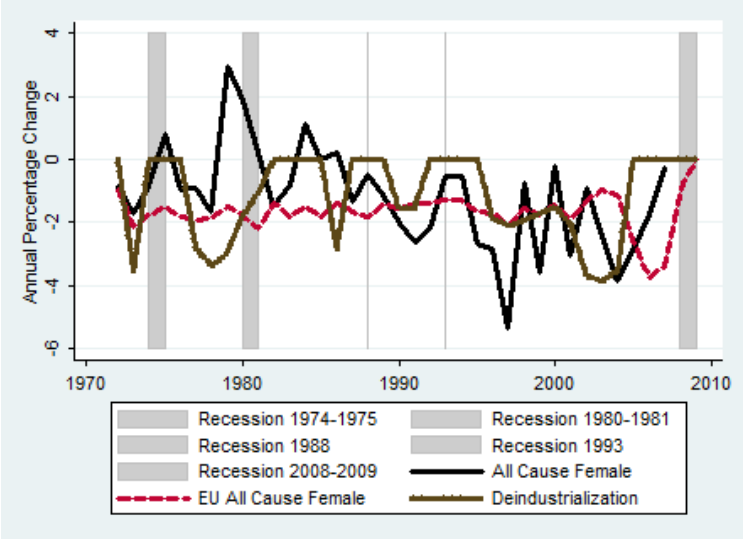
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.9 *All-cause male Denmark*



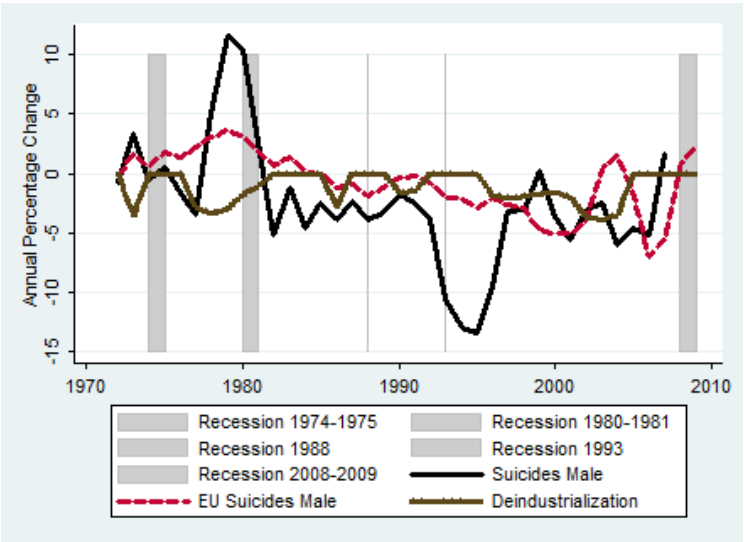
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.10 *All-cause female Denmark*



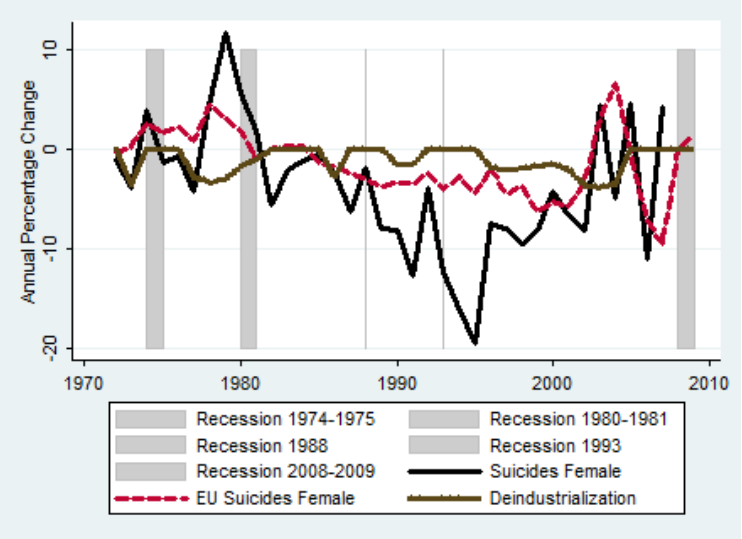
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.11 *Suicides male Denmark*



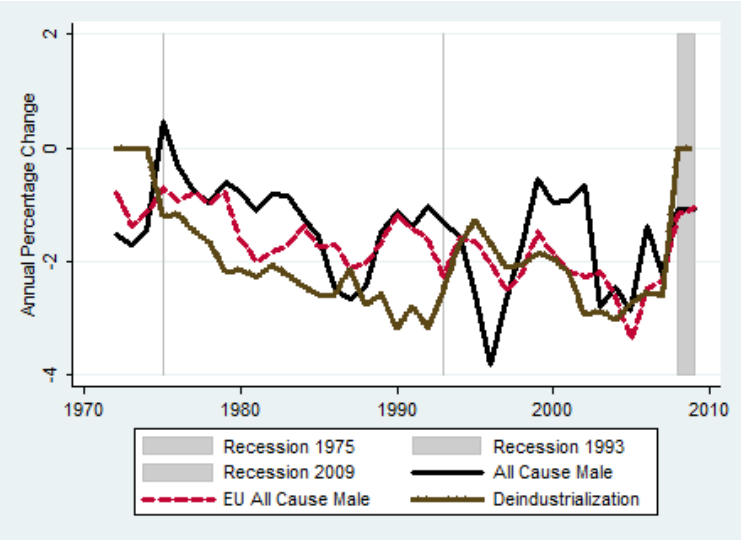
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.12 *Suicides female Denmark*



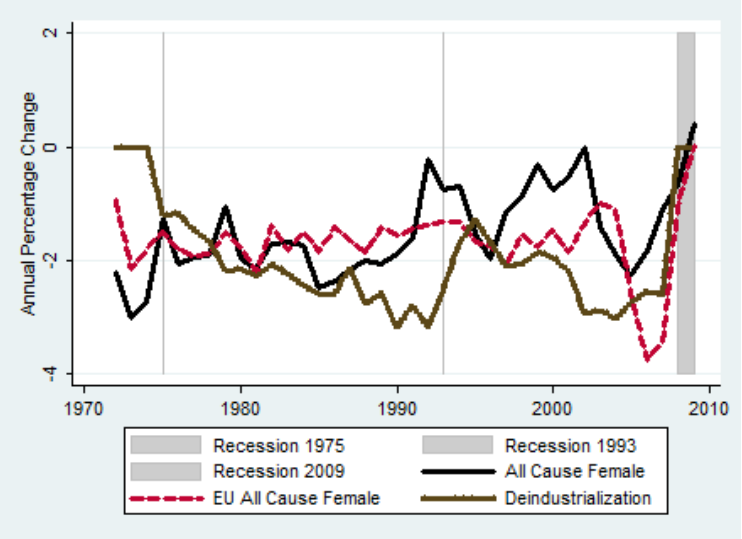
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.13 *All-cause male France*



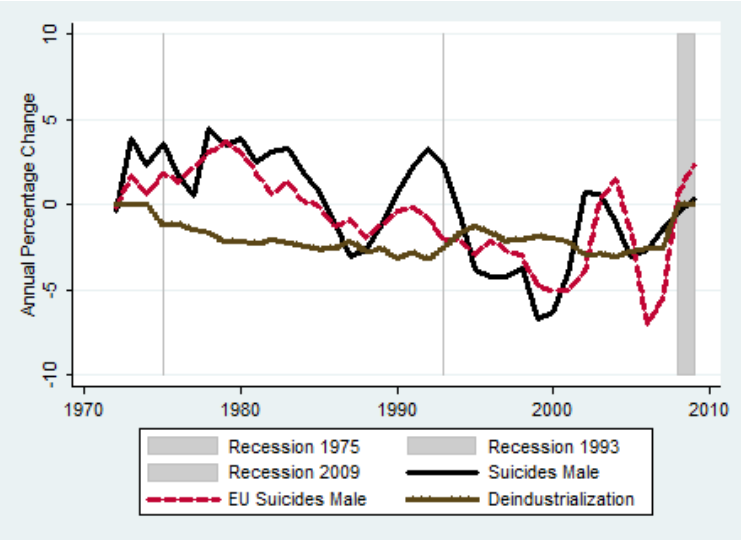
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.14 *All-cause female France*



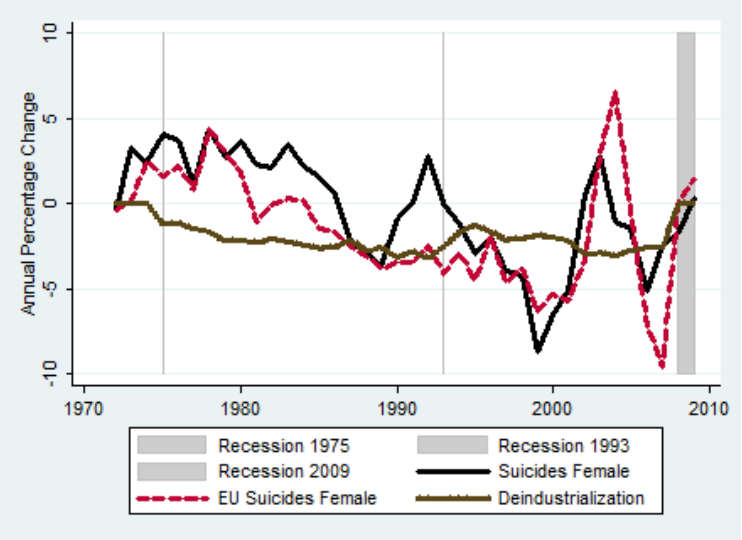
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.15 *Suicides male France*



Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure C.16 *Suicides female France*

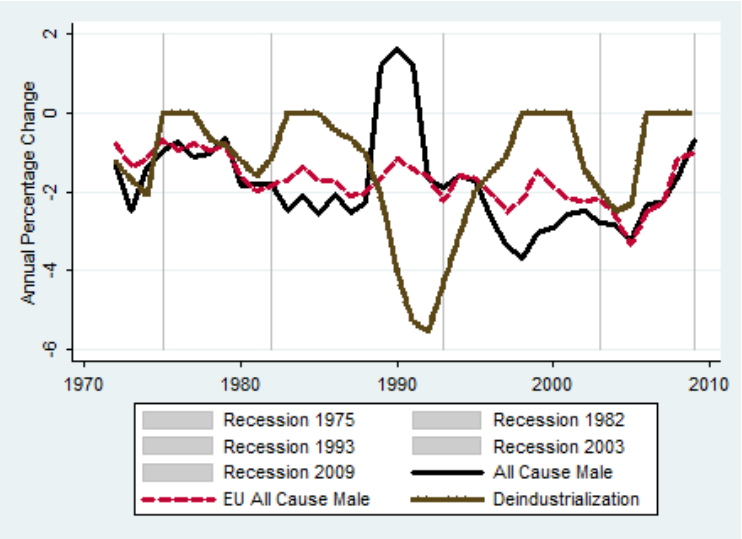


Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Appendix D

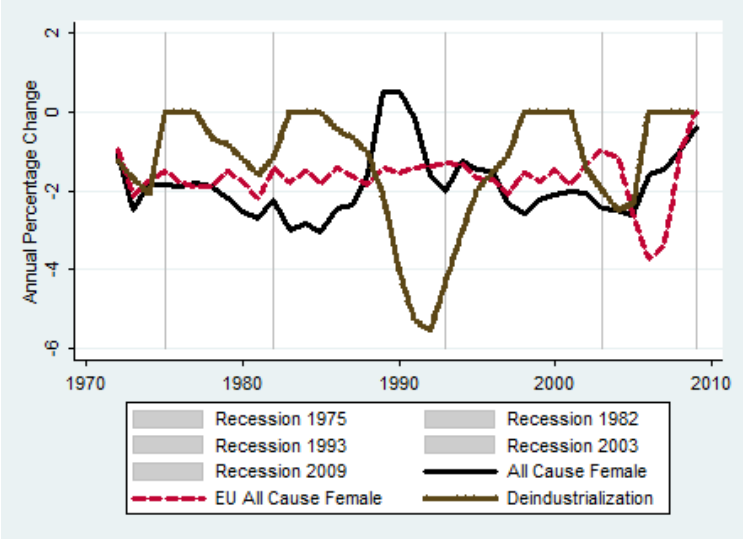
All-cause and suicides trends - Group2

Figure D.1 *All-cause male Germany*



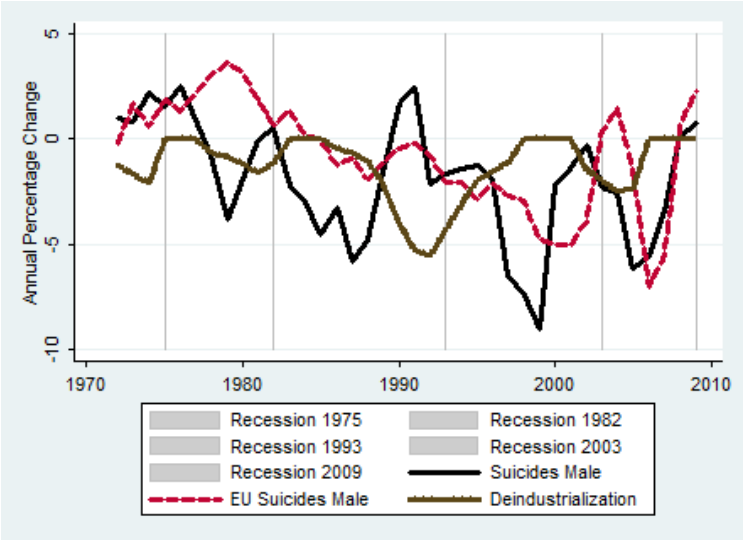
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.2 *All-cause female Germany*



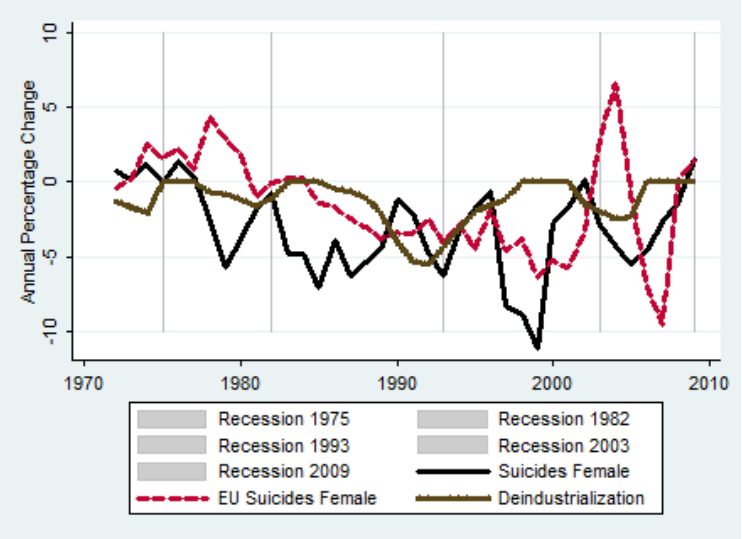
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.3 *Suicides male Germany*



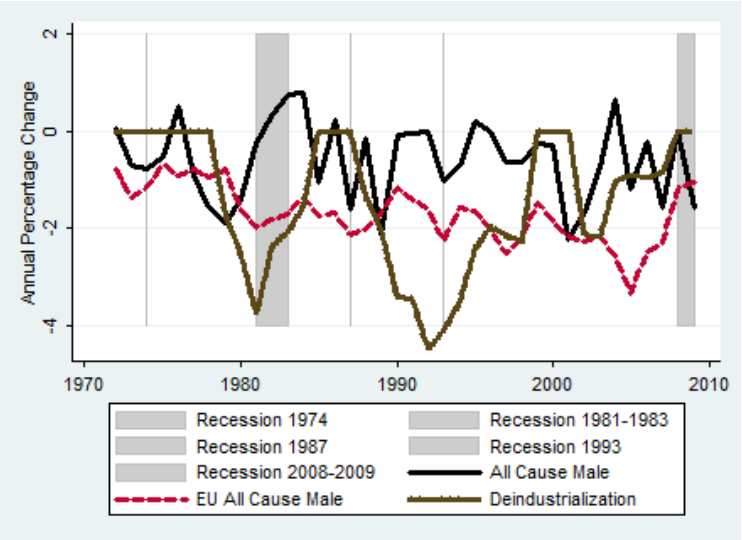
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.4 *Suicides female Germany*



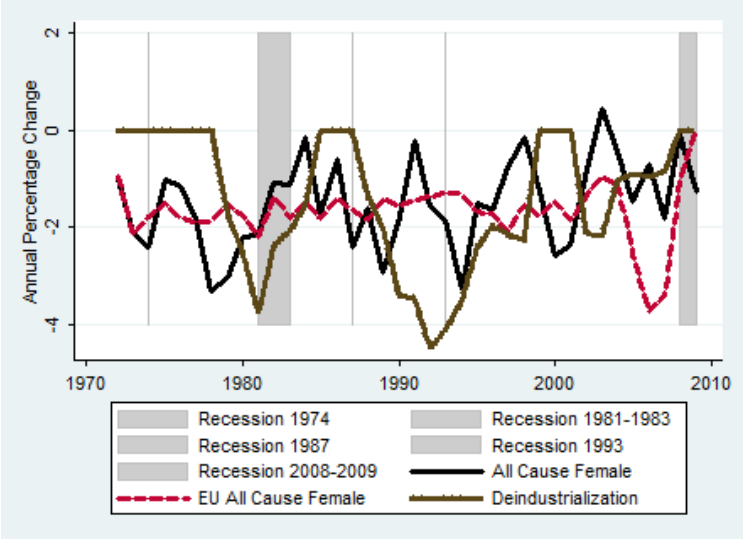
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.5 *All-cause male Greece*



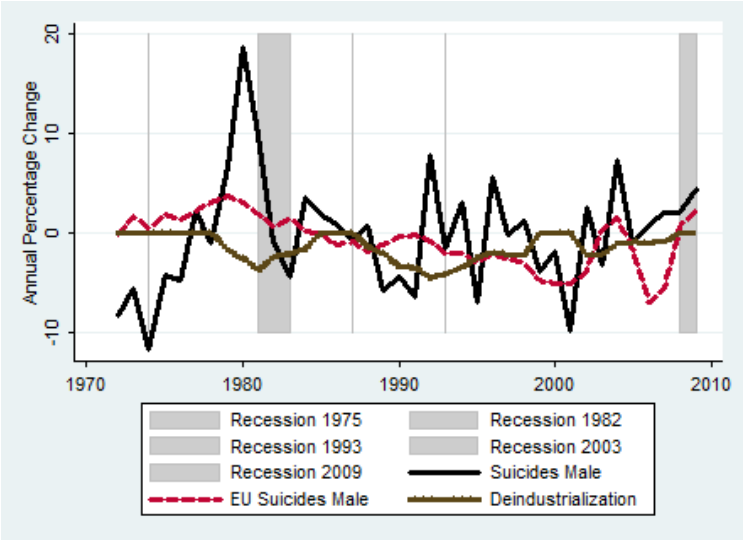
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.6 *All-cause female Greece*



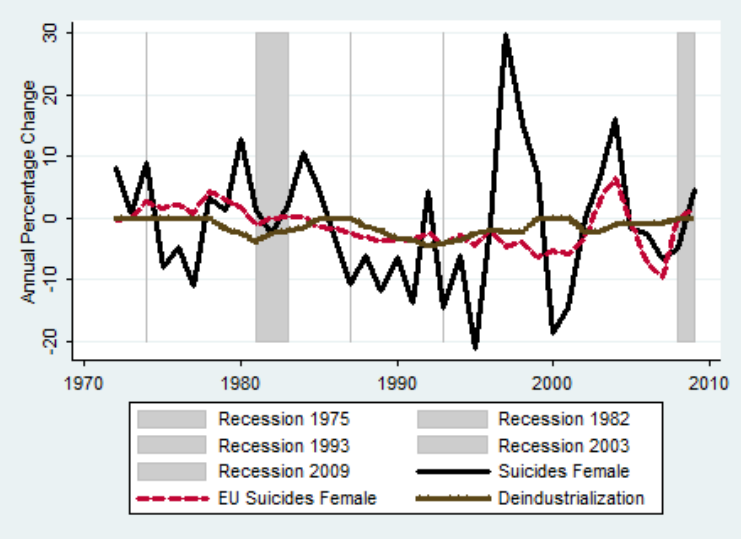
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.7 *Suicides male Greece*



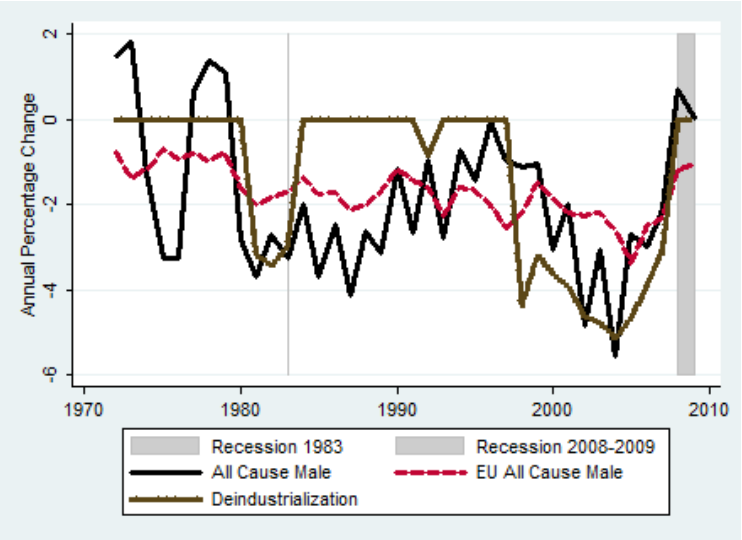
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.8 *Suicides female Greece*



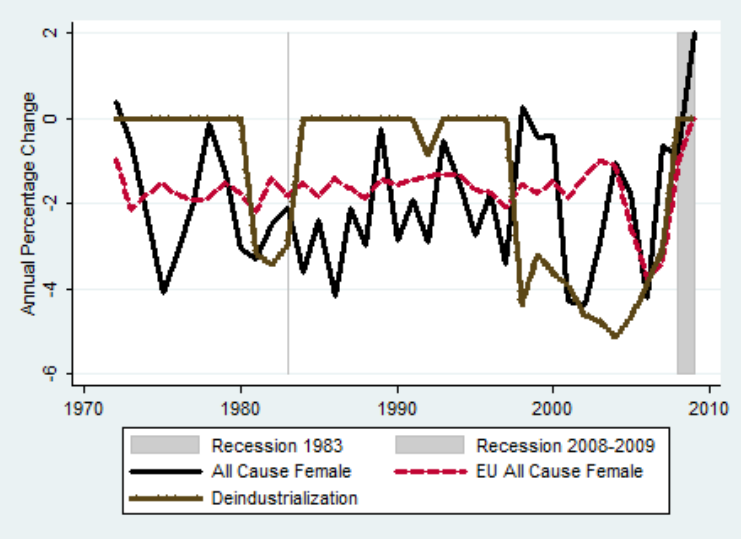
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.9 *All-cause male Ireland*



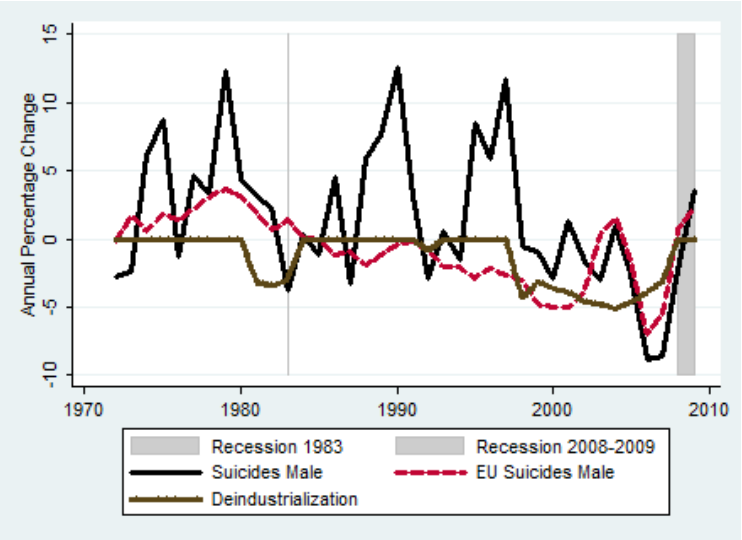
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.10 *All-cause female Ireland*



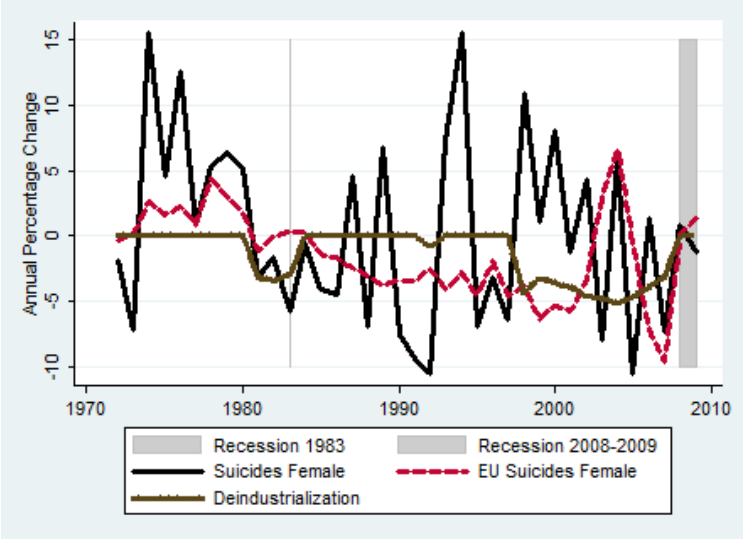
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.11 *Suicides male Ireland*



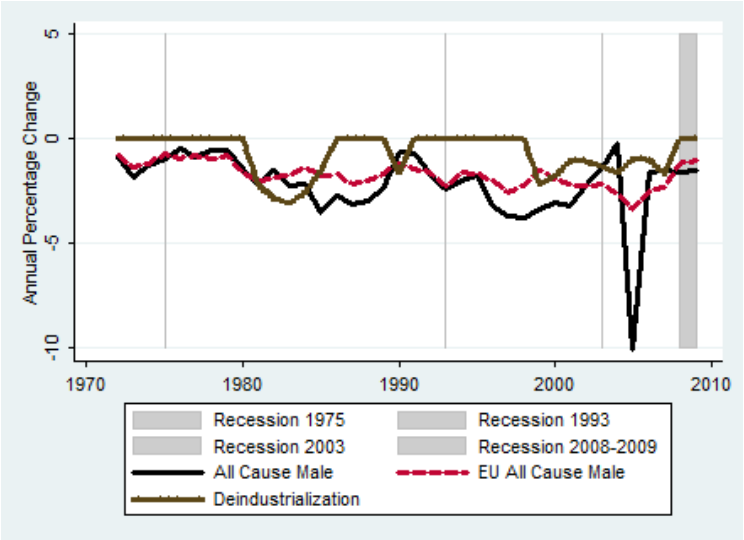
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.12 *Suicides female Ireland*



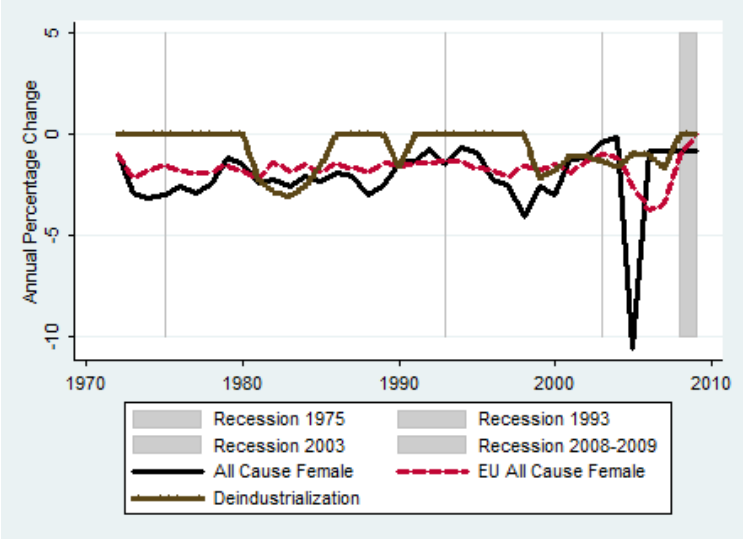
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.13 *All-cause male Italy*



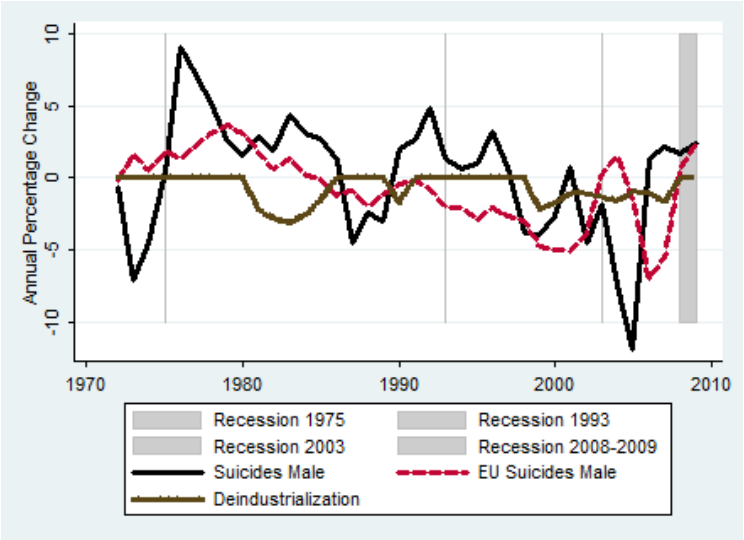
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.14 *All-cause female Italy*



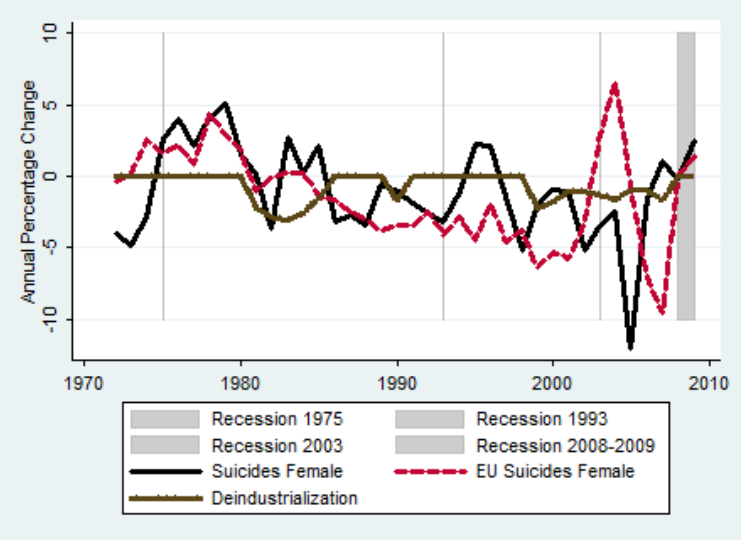
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.15 *Suicides male Italy*



Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure D.16 *Suicides female Italy*

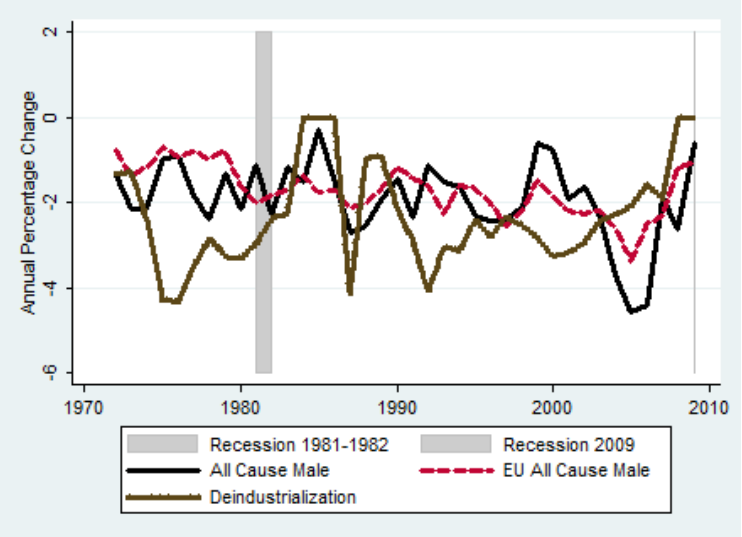


Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Appendix E

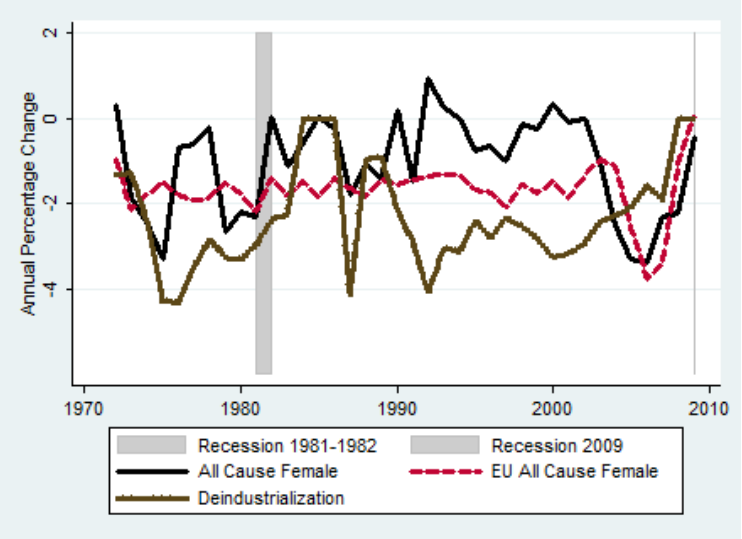
All-cause and suicides trends - Group3

Figure E.1 *All-cause male Netherlands*



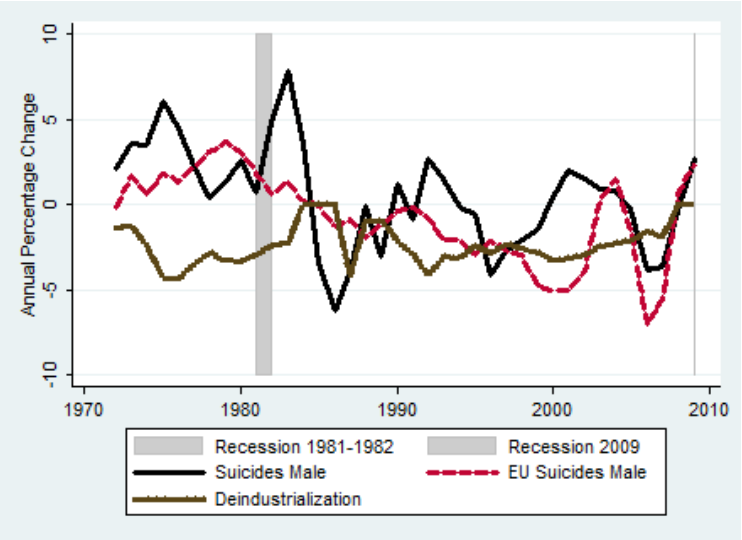
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.2 *All-cause female Netherlands*



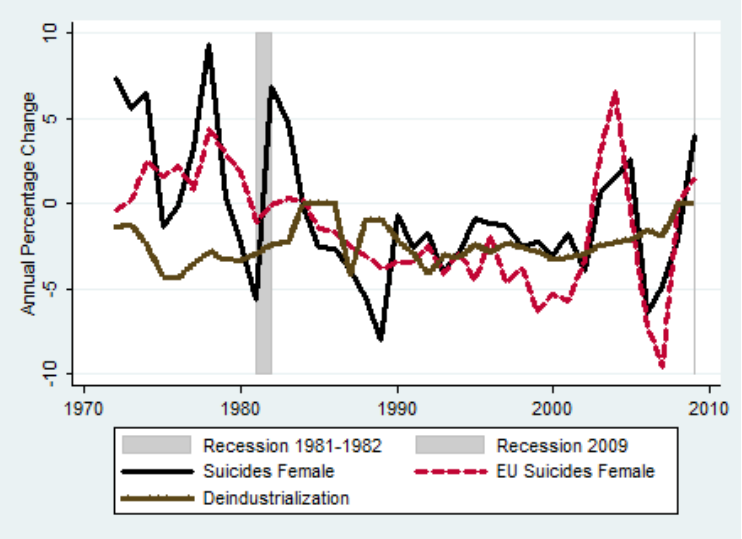
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.3 *Suicides male Netherlands*



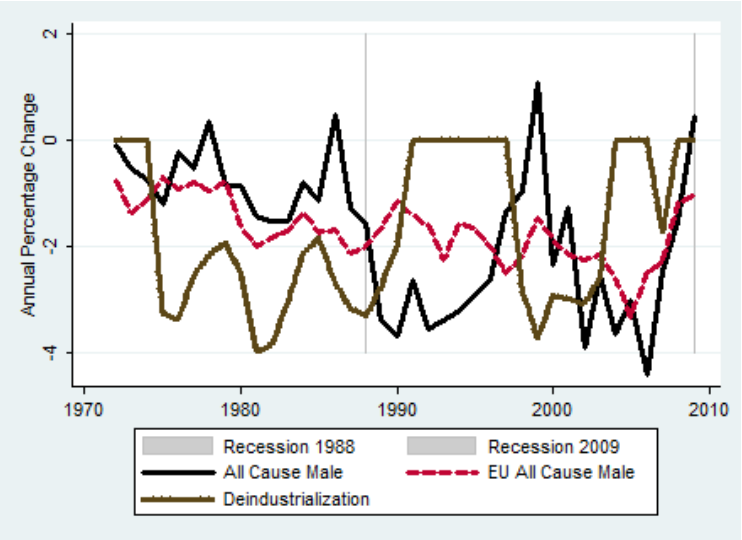
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.4 *Suicides female Netherlands*



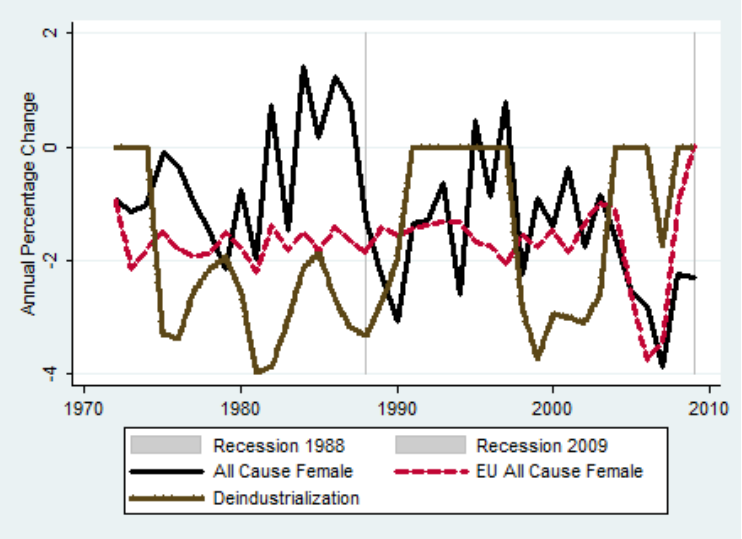
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.5 *All-cause male Norway*



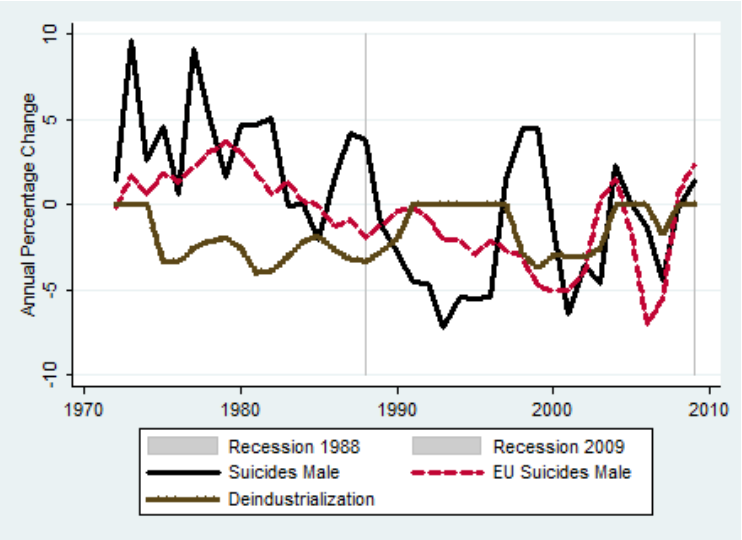
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.6 *All-cause female Norway*



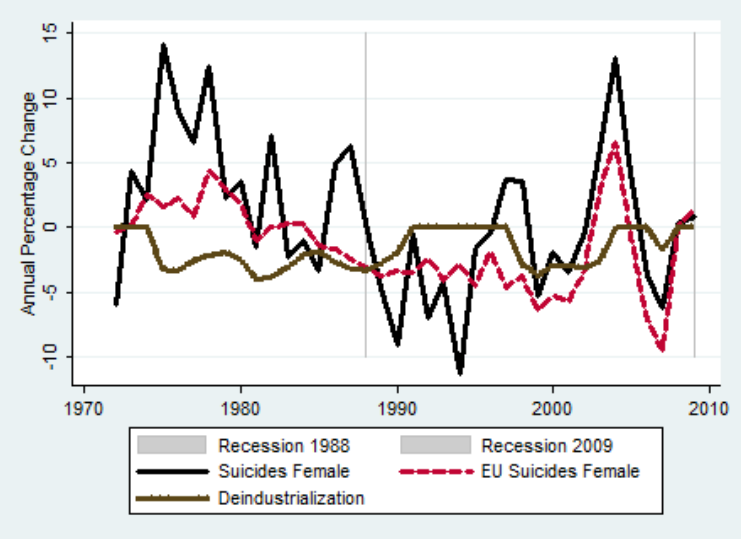
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.7 *Suicides male Norway*



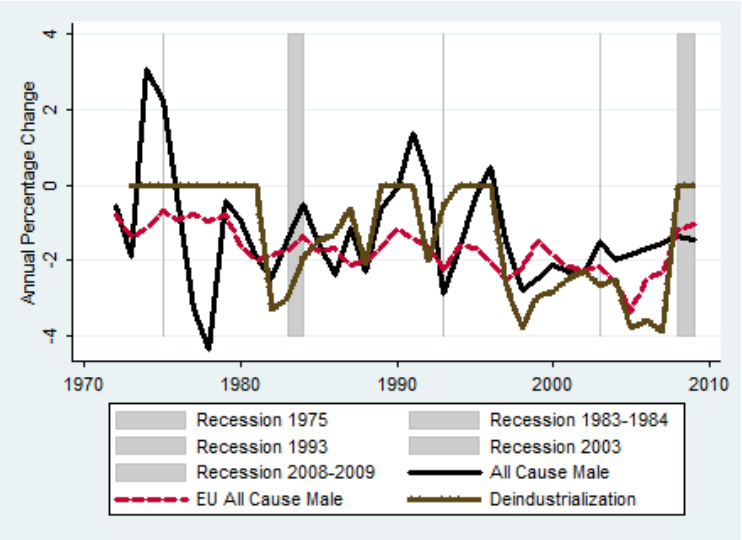
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.8 *Suicides female Norway*



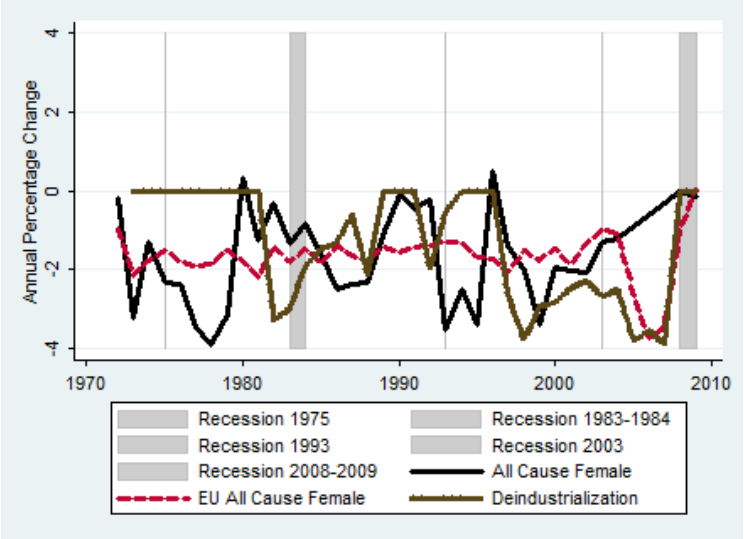
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.9 *All-cause male Portugal*



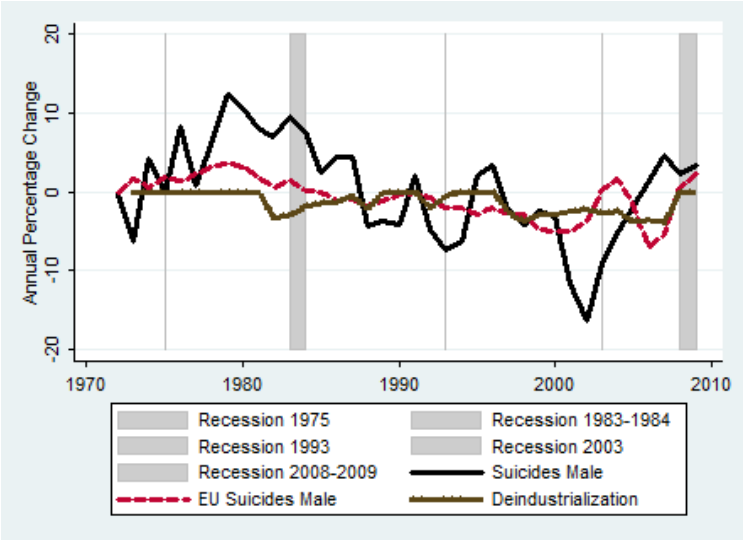
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.10 *All-cause female Portugal*



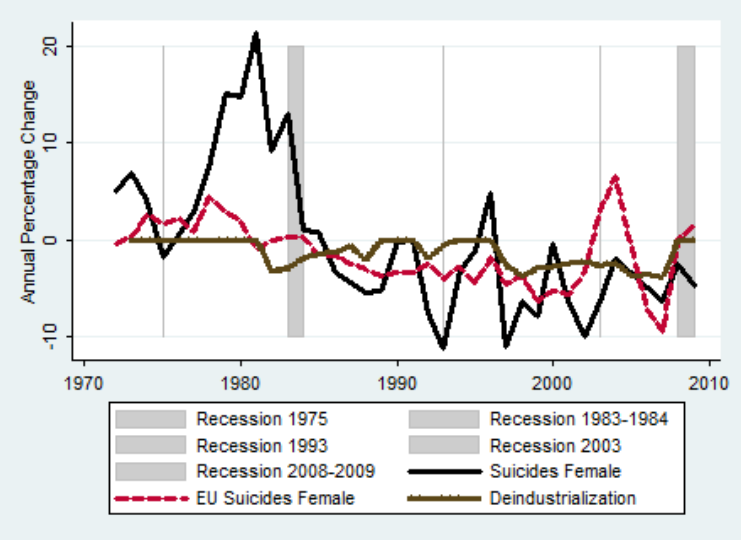
Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.11 *Suicides male Portugal*



Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Figure E.12 *Suicides female Portugal*



Annual Change - Moving Average 3 years. Magnitude DZ. Source Own calculations - WHO Database

Appendix F

Longitudinal analysis

F.1 Descriptive information and analysis

Table F.1 *Division of industries and services*

Type	**Sector**	**Codes**
Industry	Mining	10-14
	Manufacturing	15-37 150-370
	Energy	400 401 402 403 41
	Construction	45
High-Paid Services	Finances	65-67
	Real Estate-Business Activities-Research	70 72 73 7411-7415 742-744
	Public Administration/ Social Security	7511-7514 7521-7525 753 750
	Education	800 801 8021 8022 8031 8032 8041 8042
	Transport Storage-Communication	600-603 61 62 630-634 640-642
	Health and Social Work	8511-8514 850-853
	Extra territorial Organizations	99
Low-Paid Services	Sales-Retail Trades	500-505 51 52 530
	Renting	71
	Hotel-Restaurants	550-555
	Community Social Services	90 91 920-927 93
	Households with employed persons	95
	Low Business	740 745-748

Source: Scottish Longitudinal Study

Table F.2 *Categories of indicators and outcome variables*

Indicators 1991	**Categories**	**Description**
LLTI (Outcome1)	0.No 1.Yes	Limiting long-term Illness 2001
Health (Outcome 2)	0.Good/Fairly Good 1.Not Good	Health Status 2001
Occupational Groups	0.Remained in Mining & Manufacturing (base category 1991-2001) 1.Remained Con./Energy (1991-2001) 2.Changed Industry 3.&4.Employed Services 2001 (H.& L.) (from Industry 1991) 5.&6.Employed in Industry 2001 (H.& L.Services 1991) 7.& 8.Remained in H.& L.Services (1991-2001) 9.Changed Services 10.Unemployed (Industry 1991) 13.Inactive (Industry 1991) 11.& 12.Unemployed 14.&15.Inactive (H.& L.Services 1991)	A combined variable based on economic activity and sector
Age and Sex	0.20-24 (base category) 1.25-29 2.30-34 3.35-39 4.40-44 5.45-49 6.50-54 1.male 0.female	Age and Sex 1991 recoded
Marital Status	0.Single (base category) 1.Married/Remarried 2.Widowed/Divorced	Marital Status 1991
Education	0.First/Higher Education (base category) 1.Other Non-Degree 2.No Qualifications	Qualifications 1991
Housing Tenure	0.Owner (base category) 1.Private rented 2.Social rented	Housing Tenure 1991
Rooms	0.Three (base category) 1.Two or less 2.Four or more	Rooms 1991
Cars	0.Owns a car 1. No car	Car ownership 1991
Central Heating	0.Has CH 1.No CH	Central Heating 1991
LLTI	0.No 1.Yes	Limiting long-term illness 1991

Source: Scottish Longitudinal Study

Table F.3 *Descriptive table activity by sector 2001 and socio-economic indicators 1991*

Indicators 1991	Remained Min./Man.	Remained Con./Energy	Changed Industry	Employed H.Services From Industry	Employed L.Services From Industry	Total
			Age 1991			
20-24	833-10%	468-5.6%	180-2.2%	544-6.5%	365-4.4%	8340-100%
25-29	1097-10.8%	567-5.6%	212-2.1%	570-5.6%	383-3.8%	10136-100%
30-34	1041-10.4%	588-5.9%	186-1.9%	553-5.5%	377-3.8%	10022-100%
35-39	1075-11%	530-5.4%	142-1.4%	453-4.6%	327-3.3%	9812-100%
40-44	1028-10.1%	501-5%	166-1.6%	450-4.4%	349-3.4%	10186-100%
45-49	768-9.4%	368-4.5%	121-1.5%	327-4%	253-3.1%	8199-100%
50-54	320-5%	224-3.5%	52-0.8%	120-1.9%	141-2.2%	6455- 100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			Gender 1991			
Male	4748-14.4%	3055 9.3%	950-2.9%	2035-6.2%	1475-4.5%	32968-100%
Female	1414-4.7%	191-0.6%	109-0.4%	982-3.2%	720-2.4%	30182-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			Marital Status 1991			
Single	1496-9.9%	752-5%	290-1.9%	850-5.6%	567-3.7%	15100-100%
Married /Remarried	4422-9.9%	2363-5.3%	728-1.6%	2027-4.6%	1505-3.4%	44506-100%
Divorced /Widowed	244-6.9%	131-3.7%	41-1.2%	140-3.9%	123-3.5%	3544-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			Educational Qualifications 1991			
First Higher	355-5.6%	115-1.8%	34-0.5%	343-5.4%	89-1.4%	6383-100%
Other	500-6.3%	195-2.4%	63-0.8%	375-4.7%	120-1.5%	7992-100%
No Qualification	5307-10.9%	2936-6%	962-2%	2299-4.7%	1986-4.1%	48775-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			Car Ownership 1991			
No car	1013-9.2%	422-3.8%	172-1.6%	487-4.4%	395-3.6%	11024-100%
Owns a car	5149-9.9%	2824-5.4%	887-1.7%	2530-4.8%	1800-3.4%	52126-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%

Source: Scottish Longitudinal Study

Table F.4 *Descriptive table activity by sector 2001 and socio-economic indicators 1991*

Indicators 1991	Remained Min./Man.	Remained Con./Energy	Changed Industry	Employed H.Services From Industry	Employed L.Services From Industry	Total
			Housing Tenure 1991			
Owner	4355-9.6%	2337-5.2%	712-1.6%	2217-4.9%	1431-3.2%	45256-100%
Social rented	1617-10.9%	786-5.3%	306-2.1%	678-4.6%	673-4.5%	14834-100%
Private rented	190-6.2%	123-4%	41-1.3%	122-4%	91-3%	3060-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			Central Heating 1991			
Yes	5368-10%	2733-5.1%	893-1.7%	2570-4.8%	1827-3.4%	53844-100%
No	794-8.5%	513-5.5%	166-1.8%	447-4.8%	368-3.9%	9306-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			Rooms 1991			
Two or less	175-9%	90-4.6%	29-1.5%	126-6.5%	66-3.4%	1941-100%
Three	549- 9.1%	293- 4.9%	106-1.8%	324-5.4%	214-3.6%	6014-100%
Four or more	5438-9.8%	2863-5.2%	924-1.7%	2567-4.6%	1915-3.5%	55195-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%
			LLTI 1991			
Has LLTI	109-7.3%	36-2.4%	16-1.1%	52-3.5%	43-2.9%	1499-100%
Does not LLTI	6053-9.8%	3210-5.2%	1043-1.7%	2965-4.8%	2152-3.5%	61651-100%
Total	6162-9.8%	3246-5.1%	1059-1.7%	3017-4.8%	2195-3.5%	63150-100%

Source: Scottish Longitudinal Study

Table F.5 *Descriptive table activity by sector 2001 and socio-economic indicators 1991*

Indicators 1991	Employed Industry from High.Services	Employed Industry from Low.Services	Remained H.Services	Remained L.Services	Changed Services	Total
			Age 1991			
20-24	224-2.7%	297-3.6%	2284-27.4%	1194 -14.3%	894-10.7%	8340-100%
25-29	243-2.4%	314-3.1%	3284-32.4%	1352-13.3%	962 -9.5%	10136-100%
30-34	214 -2.1%	281-2.8%	3581-35.7%	1256-12.5%	973-9.7%	10022-100%
35-39	224-2.3%	232-2.4%	3691-37.6%	1222-12.4%	887-9%	9812-100%
40-44	183-1.8%	189-1.9%	3529 - 34.6%	1294-12.7%	825-8.1%	10186-100%
45-49	127-1.6%	157-1.9%	2226-27.1%	905-11%	564-6.9%	8199-100%
50-54	79-1.2%	72-1.1%	854-13.2%	447-6.9%	278-4.3%	6455-100%
Total	1294-2%	1542-2.4%	19449-30.1%	7670-12.1%	5383-8.5%	63150-100%
			Gender 1991			
Male	913-2.8%	956-2.9%	8287-25.1%	3484-10.6%	1984-6%	32968-100%
Female	381-1.3%	586-1.9%	11162-37%	4186-13.9%	3399-11.3%	30182-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670 -12.1%	5383-8.5%	63150-100%
			Marital Status 1991			
Single	374-2.5%	447-3%	4723-31.3%	1934-12.8%	1340-8.9%	15100-100%
Married /Remarried	864-1.9%	1018-2.3%	13756-30.9%	5269-11.8%	3695-8.3%	44506-100%
Divorced /Widowed	56-1.6%	77-2.2%	970-27.4%	467-13.2%	348-9.8%	3544-100%
Total	1294-2 %	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%
			Educational Qualifications 1991			
First Higher	145-2.3%	58-0.9%	3719-58.3%	370-5.8%	417-6.5%	6383-100%
Other	165-2.1%	73-0.9%	4386-54.9%	289-3.6%	484-6.1%	7992-100%
No Qualification	984-2%	1411-2.9%	11344-23.3%	7011-14.4%	4482-9.2%	48775-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%
			Car Ownership 1991			
No car	190-1.7%	289-2.6%	2643-24%	1529-13.9%	1076-9.8%	11024-100%
Owns a car	1104-2.1%	1253-2.4%	16806-32.2%	6141-11.8%	4307-8.3%	52126-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%

Source: Scottish Longitudinal Study

Table F.6 *Descriptive table activity by sector 2001 and socio-economic indicators 1991*

Indicators 1991	Employed Industry from High.Services	Employed Industry from Low.Services	Remained H.Services	Remained L.Services	Changed Services	Total
			Housing Tenure 1991			
Owner	964-2.1%	972-2.1%	15650-34.6%	5026-11.1%	3628-8%	45256-100%
Social rented	257-1.7%	477-3.2%	2853-19.2%	2148-14.5%	1400-9.4%	14834-100%
Private rented	73-2.4%	93-3%	946-30.9%	496-16.2%	355-11.6%	3060-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%
			Central Heating 1991			
Yes	1108-2.1%	1274-2.4%	17026-31.6%	6382-11.8%	4509-8.4%	53844-100%
No	186-2%	268-2.9%	2423-26%	1288-13.8%	874-9.4%	9306-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%
			Rooms 1991			
Two or less	41-2.1%	48-2.5%	591-30.4%	245-12.6%	168-8.7%	1941-100%
Three	122-2%	175-2.9%	1664-27.7%	791-13.1%	503-8.4%	6014-100%
Four or more	1131-2%	1319-2.4%	17194-31.1%	6634-12%	4712-8.5%	55195-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%
			LLTI 1991			
Has LLTI	28-1.9%	24-1.6%	298 -19.9%	150-10%	99-6.6%	1499-100%
Does not LLTI	1266-2%	1518-2.5%	19151-31.1%	7520-12.2%	5284-8.6%	61651-100%
Total	1294-2%	1542-2.4%	19449-30.8%	7670-12.1%	5383-8.5%	63150-100%

Source: Scottish Longitudinal Study

Table F.7 *Descriptive table activity by sector 2001 and socio-economic indicators 1991*

Indicators 1991	Unemployed Industry	Unemployed H.Services	Unemployed L.Services	Inactive Industry	Inactive H.Services	Inactive L.Services	Total
			Age 1991				
20-24	60-0.7%	50 -0.6%	59-0.7%	240-2.9%	312-3.7%	336-4%	8340-100%
25-29	83-0.8%	55-0.5%	84-0.8%	248-2.4%	381-3.8%	301-3%	10136-100%
30-34	86-0.9%	55-0.5%	71-0.7%	210-2.1%	304-3%	246-2.4%	10022-100%
35-39	99-1%	45-0.5%	61-0.6%	216-2.2%	316-3.2%	292-3%	9812-100%
40-44	120-1.2%	81-0.8%	65-0.6%	380-3.7%	634-6.2%	392-3.8%	10186-100%
45-49	96-1.2%	68-0.8%	46-0.6%	599-7.3%	1073-13.1%	501-6.1%	8199-100%
50-54	56-0.9%	27-0.4%	23-0.4%	1102-17.1%	1824-28.3%	836-12.9%	6455- 100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150- 100%
			Gende 1991r				
Male	492-1.5%	230-0.7%	235-0.7%	1843-5.6%	1573-4.8%	708-2.1%	32968-100%
Female	108-0.4%	151-0.5%	174-0.6%	1152-3.8%	3271-10.8%	2196-7.3%	30182-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904 -4.6%	63150-100%
			Marital Status 1991				
Single	171-1.1%	127-0.8%	124-0.8%	565-3.7%	797-5.3%	543-3.6%	15100-100%
Married/Remarried	392-0.9%	217-0.5%	249-0.6%	2238-5%	3669-8.2%	2094-4.7%	44506-100%
Divorced/Widowed	37-1%	37-1%	36-1%	192-5.4%	378-10.7%	267-7.5%	3544-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%
			Educational Qualifications 1991				
First Higher	25-0.4%	38-0.6%	9-0.1%	71-1.1%	514-8%	81-1.3%	6383-100%
Other	36-0.4%	71-0.9%	20-0.2%	177-2.2%	931-11.6%	107-1.3%	7992-100%
No Qualification	539-1.1%	272-0.6%	380-0.8%	2747-5.6%	3399-7%	2716-5.6%	48775-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%
			Car Ownership 1991				
No car	178-1.6%	101-0.9%	104-0.9%	805-7.3%	863-7.8%	757-6.9%	11024-100%
Owns a car	422-0.8%	280-0.5%	305-0.6%	2190-4.2%	3981-7.6%	2147-4.1%	52126-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%

Source: Scottish Longitudinal Study

Table F.8 *Descriptive table activity by sector 2001 and socio-economic indicators 1991*

Indicators 1991	Unemployed Industry	Unemployed H.Services	Unemployed L.Services	Inactive Industry	Inactive H.Services	Inactive L.Services	Total
			Housing Tenure 1991				
Owner	341-0.7%	239-0.5%	223-0.5%	1801-4%	3620-8%	1740-3.8%	45256-100%
Social rented	239-1.6%	114-0.8%	157-1.1%	1124-7.6%	998-6.7%	1007-6.8%	14834-100%
Private rented	20-0.6%	28-0.9%	29-0.9%	70-2.3%	226-7.4%	157-5.1%	3060-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%
			Central Heating 1991				
Yes	472-0.9%	308-0.6%	321-0.6%	2512-4.7%	4196-7.8%	2345-4.4%	53844-100%
No	128-1.4%	73-0.8%	88-0.9%	483-5.2%	648-7%	559-6%	9306-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%
			Rooms 1991				
Two or less	28-1.4%	19-1%	14-0.7%	93-4.8%	115-5.6%	93-4.8%	1941-100%
Three	65-1.1%	35-0.6%	55-0.9%	329-5.5%	450-7.5%	339-5.6%	6014-100%
Four or more	507-0.9%	327-0.6%	340-0.6%	2573-4.7%	4279-7.7%	2472-4.5%	55195-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%
			LLTI 1991				
Has LLTI	12-0.8%	17-1.1%	16-1.1%	181-12.1%	254-16.9%	164-10.9%	1499-100%
Does not LLTI	588-0.9%	364-0.6%	393-0.6%	2814-4.6%	4590-7.4%	2740-4.4%	61651-100%
Total	600-0.9%	381-0.6%	409-0.6%	2995-4.7%	4844-7.7%	2904-4.6%	63150-100%

Source: Scottish Longitudinal Study

Table F.9 *Logistic regression not good health*

Indicators 1991	Model 1	Model 2	Model 3
		Age	
20-24 (base)			
25-29	1.24(1.06-1.45)**	1.24(1.06-1.46)**	1.22(1.03-1.43)*
30-34	1.77(1.52 -2.06)**	1.78(1.51-2.09)**	1.70(1.44-2.00)**
35-39	2.57(2.22-2.97)**	2.65(2.26-3.11)**	2.54(2.16-2.99)**
40-44	2.38(2.06-2.74)**	2.53(2.16-2.96)**	2.40(2.05-2.81)**
45-49	1.87(1.62-2.15)**	2.05(1.74-2.40)**	1.96(1.67-2.30)**
50-54	0.99(0.86-1.14)	1.08(0.92-1.27)	1.01(0.86-1.19)
		Gender	
Females (base)			
Males	1.49(1.39-1.60)**	1.55(1.45-1.67)**	1.51(1.41-1.62)**
		Marital Status	
Single (base)			
Married/Remarried		1.08(0.97-1.19)	1.10(0.99-1.21)
Divorced/Widowed		1.23(1.06-1.42)**	1.23(1.06-1.43)**
		Educational Qualifications	
First/Higher (base)			
Non Degree Qualifications		1.21(1.01-1.44)*	1.20(1.01-1.44)*
No qualifications		1.80(1.55-2.09)**	1.79(1.54-2.07)**
		Car Ownership	
Owns a car (base)			
No car		1.16(1.06-1.26)**	1.15(1.05-1.25)**
		Housing Tenure	
Owner (base)			
Social rented		1.60(1.48-1.73)**	1.57(1.45-1.70)**
Private rented		1.18(1.00-1.39)*	1.17(1.00-1.38)*
		Rooms	
Three (base)			
Two or less		1.09(0.89-1.34)	1.06(0.86-1.30)
Four or more		0.81(0.73-0.90)**	0.82(0.74-0.91)**
		Central Heating	
Has CH (base)			
No CH		1.17(1.07-1.28)**	1.18(1.08-1.30)**
		LLTI	
No (base)			
Yes			3.65(3.19-4.19)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI. Significance levels .01 ** .05*

Table F.10 *Logistic regression LLTI*

Indicators 1991	Model 1	Model 2	Model 3
		Age	
20-24 (base)			
25-29	1.30 (1.14-1.47)**	1.34(1.17-1.53)**	1.30(1.14-1.48)**
30-34	1.88(1.66-2.12)**	1.97(1.72-2.24)**	1.85(1.62-2.12)***
35-39	2.55(2.27-2.87)**	2.74(2.41-3.12)**	2.61(2.28-2.98)**
40-44	2.88(2.57-3.22)**	3.15(2.77-3.58)**	2.97(2.61-3.38)**
45-49	3.18(2.84-3.57)**	3.55(3.12-4.04)**	3.40(2.98-3.87)**
50-54	2.13(1.89-2.39)**	2.37(2.08-2.71)**	2.20(1.93-2.52)**
		Gender	
Females (base)			
Males	1.50(1.42-1.59)**	1.58(1.49-1.67)**	1.54(1.45-1.63)**
		Marital Status	
Single (base category)			
Married/Remarried		1.01(0.93-1.09)	1.05(0.97-1.15)
Divorced/Widowed		1.14(1.01-1.29)*	1.17(1.03-1.32)*
		Educational Qualifications	
First/Higher (base)			
Non Degree Qualifications		1.30(1.14-1.48)**	1.30(1.13-1.48)**
No qualifications		1.81(1.62-2.02)**	1.80(1.61-2.02)**
		Car Ownership	
Owns a car (base)			
No car		1.15(1.07-1.24)**	1.15(1.06-1.23)**
		Housing Tenure	
Owner (base)			
Social rented		1.50(1.41-1.60)**	1.46(1.37-1.56)**
Private rented		1.09(0.96-1.25)	1.08(0.94-1.24)
		Rooms	
Three (base)			
Two or less		1.02(0.86-1.22)	0.97(0.81-1.16)
Four or more		0.87(0.80-0.95)**	0.88(0.80-0.97)**
		Central Heating	
Has CH (base)			
No CH		1.13(1.05-1.22)**	1.14(1.06-1.23)**
		LLTI	
No (base)			
Yes			13.14(11.56-14.94)**

Source SLS. H. and L. Services- High & Low Services. Model 1: age & sex adjusted, Model 2: age, sex & socio-economic, Model 3: age, sex, socio-economic & LLTI. Significance levels .01 ** .05*